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ABSTRACT

This is the final report for a study whose original purpose was to develop a general theory of the situational constraints imposed by the routines of everyday life on arithmetic skills. Section 1 reviews the goals laid out in the proposal in relation to what was accomplished. Section 2 is the draft of "Everyday Cognition: Its Development in Social Context." It presents a theory of problem solving as interaction between setting and activity. Section 3 is the draft of another manuscript, "The Dialectical Constitution of Arithmetic Practice." (MNS)

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Final Report

Cross-Situational, Cross-Cultural Comparison of the Learning and Use of Problem Solving Skills

NIE-G-81-0092

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Jean Lave, Principal Investigator

for

Teaching and Learning Program
National Institute of Education

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I spent the year during the grant period working full time on the project described in the proposal. Sections II and III of the final report consist of the two major written pieces prepared during the year. In this section (I) I will review the goals laid out in the proposal in relation to what was in fact accomplished. The abstract of the proposal provides a useful summary of those goals:

> The purpose of this study is to develop a general theory of the situational constraints imposed by the routines of everyday life on basic cognitive skills, specifically arithmetic skills. To achieve this goal I will compare (a) the situational constraints on, and demands for, problem solving skills in several everyday settings, (b) the kinds of arithmetic problem solving skills employed in those settings, and (c) the implications of situational variation in problem solving demands, for school instruction in arithmetic.
>
> I have, over the past few years, carried out five case studies of arithmetic skills in different everyday settings: grocery shopping, managing household finances, learning a new dieting system, and learning arithmetic in school in the U.S.; using arithmetic in tailor shops and in schools in Liberia, West Africa. The data were collected by participant observation and experiments, with emphasis on fine-grained description including protocols of problem solving activities and verbatim transcripts. Subjects included women and men who vary in age from 16 to 75. They differ in time since formal schooling was completed, in amount of formal schooling, and in income.
>
> Recent theory in psychology suggests that there are strong context-specific demands for cognitive skills. These findings raise serious questions about the potential impact of that very special educational setting, school, on the uses of basic cognitive skills in other settings. This study intends to speak to the issues of how formal instruction in arithmetic affects everyday uses of cognitive skills and how it might do so more effectively in the future.

The work accomplished during the year differs in several ways from the proposal. First of all, the scope of cross-situational comparison was greatly reduced to include arithmetic problem solving activities by grocery shoppers in supermarkets and in testing situations; comparisons with Weight

Watchers were undertaken, but in minimal fashion (so far), and no cross-cultural comparison was possible. Second, the description of settings took on a deeper and broader scope than anticipated (the section of this report entitled "The Dialectical Constitution of Arithmetic Practice" includes extensive analysis of the supermarket as a setting for grocery shopping arithmetic.) This change is closely related to the third and most important change. Some background will help to make this clear.

In the proposal I argued that the basis for cross-situational comparison would be six features of everyday problem solving situations which grew out of my earlier analysis of arithmetic problem solving in tailor shops in Liberia. These included: 1) the relative importance of arithmetic activity in relation to other activities in progress; 2) how much social interaction routinely occurs in the situation; 3) variation in the perceived cost of inaccuracy in problem solving; 4) ease or difficulty of assembling relevant information for problem solving; 5) the familiarity of problems, primarily a function of their frequency in daily routines; and 6) the impact of school learned skills on problem solving in other contexts. (See pages 10-11 in the proposal.) This was generally characterized as a model of circumstances constraining problem solving in mundane situations. After spending the fall quarter trying to apply these points to the description of supermarket arithmetic I concluded that, while relevant, they were nowhere close to a principled theory of mundane cognitive activity, in two senses: they provided neither a theory of the situational constraints on problem solving nor a theory of problem solving activity.

Therefore I initiated a sustained round of reading, in a) psychological theory concerning ecological validity; b) information processing and cognitive development theory; c) the history and criticism of psychological theory; and finally, d) recent anthropological work on social theory, the kinds of psychologies implied by different theories of relations between society and the individual, and vice versa. During this phase I consulted frequently with the project consultant. What began as a primarily comparative, synthetic project, then, ended in the development of a stronger, more coherent theoretical position--a dialectical one--concerning the nature of relations between cognitive activity, such as arithmetic, and everyday settings, such as tailor shops or supermarkets. It is no longer a constraint model, but rather, a theory of interaction between setting and activity. The section of this report entitled "Introduction to Everyday Cognition: Its Development in Social Context" is the written version of this work.

With this theoretical perspective in hand I then began the comparative enterprise, producing with my graduate student colleagues the analysis of a supermarket as a setting for grocery shopping activity, the character of that activity, problem solving in the market, and the nature of arithmetic problem solving procedures.

The "Introduction . . ." and "The Dialectical Constitution . . ." will both appear (expected 1983) in a book edited by Barbara Rogoff (Associate Professor, Psychology, University of Utah) and myself, under contract with Harvard University Press. It is entitled Everyday Cognition: Its Development in Social Context. In addition, I have presented talks at the Center for Human Information Processing, UC San Diego; two papers at the AERA meetings; and a talk at the Cognitive Science Society Meetings during the grant period. (I've given several other talks, since then, e.g., Teachers College, Columbia University; the developmental psychology colloquium, CUNY; and am scheduled for several other talks in the near future.) This book is obviously not the one described in the grant proposal (nicknamed "The Savagery of the Domestic Mind"). I consider the work carried out during the grant period to stand as an outline for, or a miniature version of, the latter book, with the theoretical part about two-thirds complete, and one of four or five specific studies in polished form. I still plan to write the book with my student colleagues. It will take us at least one more year, probably two, to complete it. The year was an extraordinarily rewarding one from my perspective as scholar and from the perspective of the future book as well: I believe it will be a far more serious and original contribution to the understanding of cognitive skills in everyday settings than it would be had I pursued my plans more literally. Meanwhile, the work, in its present form, will see publication within the year.

In closing, I wish to address the educational implications of the research. To begin with, it should be clear that these data speak to only one goal of school arithmetic instruction--the teaching of skills used in everyday life in this society today. Goals of preparing future engineers and physicists are not herein addressed; nor are goals of teaching arithmetic structures for their own sake, both of which are strongly held functions of public education. But in terms of survival skill arithmetic, it appears that very little of school arithmetic beyond integer arithmetic and arithmetic manipulation of ratios (a surprisingly important kind of problem representation in many everyday circumstances) finds its way into the constantly maintained repertoire of expert grocery shoppers.

And the methods used for solving problems are not those of paper-and-pencil algorithms which are far too cumbersome in time, effort, and paraphernalia to be feasible in shopping and most other everyday settings. Problem simplification, decomposition, concentration on relations rather than numerical solutions (i.e., "if one price rises and the other is the same, and the quantitites haven't changed, the second is the better buy"), clever methods of using the environment as a calculating device, etc.--all of these, plus all of the "test gaming" techniques which teachers seek to remove from the situation in school math exercises--are major and effective means of dealing with problems in everyday situations.

And they are extremely effective; one subject was an elderly stroke victim who could solve only two problems on the formal math test, but like all the others, she calculated rather frequently in the supermarket and never made an error. The analysis of why shoppers are so successful is not simple; it is discussed in detail in "The Dialectical Constitution . . . ." But perhaps the more useful question here is, Why is there such a discrepancy between school and store performance levels (begging the question, for the moment, of the differences in problem solving processes employed in the different settings)? We developed a specific theory to account for arithmetic activity which we call "gap-closing" arithmetic (written up in "The Dialectical Constitution of Arithmetic Practice," the last part of this report).

The theory and the method, we believe, are innovative. The application of dialectical theory involved the analysis of grocery shopping activity and the exploration of what it means to have "problems" in the process of grocery shopping, in particular, arithmetic ones. "Problems" in the context of grocery shopping appear to be small snags in familiar routine decision making processes. If arithmetic is used in the course of solving problems (as it is about 20 percent of the time), its role appears to be to provide a rationale for one choice, rather than another, when the possibilities have been reduced to a small number, but no definitive choice seems possible on qualitative criteria alone. Under these circumstances, the recognition that there is a "problem" to be solved--perhaps a "best buy" calculation--is accompanied by a good deal of knowledge about what an adequate solution would look like. Shoppers work back and forth between what they know about this answer and what the setting holds or they know that might help. This dialectical process is one of drawing the problem and a solution closer together, and both are changed in the process of solving the problem. Our analysis of problem solving processes among the shoppers helps us to account for some rather startling numerical results of other analyses. We discovered that shoppers, though they frequently make errors on intermediate steps in calculation procedures, are virtually error free (98 percent) in their final calculations. This contrasts strongly with their arithmetic performances in a test-like setting in which they averaged 59 percent on a basic arithmetic test. The section of the report alluded to previously ("The Dialectical Constitution . . .") lays out our explanation of this pehnomenon.

First of all, we have come to see as central to the process of successful problem solving the generation of problems by the problem solver. Herbert Simon and his colleagues describe people in the laboratory who successfully solve the problems assigned them by the experimenter (not self-generated problems in our terms) as spending most of their problem solving activity in representing the problem. This may be interpreted as a process of, in fact, making the problem their own. In the supermarket we found math occurring at the end of decision making processes about individual items on grocery lists. This, too, is a process of problem representation although having put it in Simon's terms to emphasize the probable similarity of the two kinds of problem solving activity, let us change it at once to fit our theoretical perspective. It is the generation of problems which at the same time generates solution shapes to problems and makes the powerful gap-closing arithmetic procedures (described in our paper) feasible. We think good problem solvers in school arithmetic situations use these procedures; but the ideology of school arithmetic instruction is one in which problems are "given" by teacher to pupils, and where problem solving is normatively considered to be a linear business where one starts with information given and proceeds to decide what operation to apply to get an answer; the operation is applied and answer obtained. It is often wrong, sometimes wildly wrong. And paper-and-pencil algorithms are used, partly to create a record that can be evaluated at some other time by teachers who are dealing simultaneously with a large number of students. There are techniques for teaching mental arithmetic, problem simplification, decomposition and recomposition--techniques appropriate to the kind of mental operations observed in the supermarket. The curriculum developed by my colleague, Professor Michael Butler, Director of the UCI Farm School for grades kindergarten through six, is a case in point. Likewise, it might be feasible to introduce into school curricula concepts of multiple methods for solving any given problem; varying precision constraints depending on the context in which the solution is relevant; and the working back and forth between solution shape and information to devise methods of problem solving.

What seems most difficult to implement in the public school system is the most essential difference between successful and unsuccessful problem solving: the process of "making the problem your own." Given the authoritarian emphasis of the system within which children learn arithmetic, I see no way, other than covertly, in subversion of the system, that children can learn and practice the techniques which they all acquire and use to good effect in contexts outside school. (Certainly making word problems more realistic won't do the trick, if the social organization of problem solving is as crucial as we believe it to be.) It is also the case that almost all of the adults we worked with recall their school arithmetic learning experiences with pain and are ashamed of their current practice of arithmetic to the point that none of them recognize how effective they are.

If school arithmetic experiences are too deeply rooted in the social organization of schooling to change, it might at least be possible to lighten the normative messages which follow children away from school into adulthood. These messages might be summed as follows: "The only right way to 'do math' is by formal paper-and-pencil algorithms, initiated on the basis of the fiction that all but only the information needed is given. In addition to this information, all that is necessary is an algorithm, which, if properly applied, will lead to an answer, about which nothing is known until it appears." It may be possible to do arithmetic this way, but it is not a useful prescription for everyday arithmetic practices; it is probably not true that the prescription applies in school either for those who are really skilled at solving problems. In fact, it may be that what distinguishes inadequate school learners is, among other things, their belief in what they are told.

I am not satisfied that sufficiently detailed information on problem solving in supermarkets, or on school arithmetic practices, has been provided here to support the conclusions just presented. However, in addition to the "Dialectical Constitution. . ." paper, documentation for the argument is presented in the final report, now in preparation for NIE-G-078-0194. The work carried out under the auspices of the present grant does, however, develop a new theoretical perspective on arithmetic in practice and demonstrate its application to arithmetic practices in the supermarket. I hope to continue on with the project as outlined in the proposal, with the more realistic and modest goal embodied in its new nickname: my next five-year plan.

Section II

EVERYDAY COGNITION: ITS DEVELOPMENT IN SOCIAL CONTEXT

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EVERYDAY COGNITION: ITS DEVELOPMENT IN SOCIAL CONTEXT

Introduction*

Jean Lave

I.

THE CONTROVERSIAL NATURE OF THE ENTERPRISE

Why should we want to take up the study of everyday thought in context? After all, the very term "everyday," when applied to thought, has been imbued with pejorative connotations; arguably, in fact, its analytic meaning has typically been derived by comparison to the prescriptively superior canons of scientific thought. Moreover, the study of everyday behavior, when it is assumed to vary strikingly across situations, has been damned as a rejection of theory and a move towards descriptive particularism. Even granting intrinsic value to the study of "what people really do," it has been made to appear that doing so requires a lamentable sacrifice of methodological rigor--assumed to be impossible to achieve outside the experimental context--in order to gain relevance to the concerns of everyday cognition. Yet I, and to one degree or another, the majority of my colleagues in this project, reject not only this caricatured view of the study of cognition in social context, but the problematique which claims that these particular issues are central ones. However, there is no simple response to the initial question. If we are to arrive at an account of our views on the matter, it is necessary to begin with a consideration of how everyday thought has been conceptualized and investigated in the past, thereby acquiring its specifically negative and residual character, while at the same time its elucidation remains among the ultimate goals of psychological research.[1]

Everyday and Scientific Modes of Thought

The fact that "everyday thinking" has classically been treated residually, by contrast with other "modes of thought," rather than as a phenomenon in its own right, is not difficult to demonstrate. Thus, for example, Bartlett (1958, p. 164) suggested some 20 years ago, that

> By everyday thinking I mean those activities by which most people when they are not making any particular attempt to be logical or scientific try to fill up gaps in information available to them . . . (emphasis added.)

In expressing this view, Bartlett was echoing a very general view, with long-standing roots. Thus, late nineteenth-century social evolutionists, concentrating on the nature of reason and logic, were more concerned with the comparative analysis of rationality than with a unified theory of mind, or its "everyday" manifestations. Lévy-Bruhl, to take a celebrated instance, defined as his problem the affirmation of the non-rationality of primitive thought--in contrast to the image of a western homo logicas--and argued bitterly against the universalist rationalism essayed by British anthropologists in explaining the existence of "primitive" beliefs (1910, pp. 6-10). It is curious that Lévy-Bruhl and his contemporaries did not conceive the exercise to be one of theorizing about the nature of the mind--this was taken for granted, as a set of basic assumptions rather than as the goal of the investigation.[2]

> As far as the mentality peculiar to our society is concerned, since it is only to serve me as a state for comparison, I shall regard it as sufficiently well defined in the works of philosophers, logicians and psychologists, both ancient and modern, without conjecturing what sociological analysis of the future may modify in the results obtained by them up to the present (Lévy-Bruhl, 1910, p. 19).

The enterprise was not conceived by late nineteenth-century students of relations between culture and cognition as a philosophical or theoretical debate, but was given form in a comparative framework in which categories of thinking operations and taxonomies of modes of thought were elaborated in the service of evolutionary schemes (not coincidentally related to categories of child development as well). The dichotomy between mind and body underlying Western epistemologies provided the framework for a similarly dichotomized sub-classification of scientific (rational) versus primitive (non-rational or irrational) modes of thought. Subsumed within this set of categories was another pair of mutually defining terms, scientific and everyday thought. This polar dichotomy, found in the work of Tylor, Lévy-Bruhl and Boas (among others) as an unmarked implication of the higher order classificatory opposition between primitive and scientific modes of thought,[3] has recently become more central in the investigation of thinking (e.g. Goody, 1977; Cole, Hood and McDermott, 1978; Bronfenbrenner, 1979; Neisser, 1976). It appears that "everyday thinking" has taken on, or taken over, the characteristics attributed to primitive thought, by virtue of its identical relationship with the characteristics ascribed to scientific thought. Goody (1977) summarizes (from the work of Lévi-Strauss) what he calls the "Grand Dichotomy" (p. 146ff.) between characteristics of modes of thought, assigned to separate stages of culture.

Domesticated Cultures	Wild Cultures
'hot'	'cold'
modern	neolithic
science of the abstract	science of the concrete
scientific thought	mythical thought
scientific knowledge	magical thought
engineer(ing)	bricoleur(age)
abstract thought	intuition/imagination/perception
using concepts	using signs
history	atemporality; myths and rites

Goody sums up,

> "In the simplest terms, /this/ is a contrast between the domination of abstract science together with history, as

> against the more concrete forms of knowledge . . . . of 'primitive' peoples." (p. 148).

This and other schemes of types of thought have, as their negative pole, imagined descriptions of primitive thought: emotional, concrete, illogical, preliterate, closed, magical, etc. The list of adjectives is long and not laudatory within the framework of folk and social science views on cognition. My own position, which argues the historical and artefactual basis of these descriptions is very close to that of Barnes (1973, p. 182). Although he speaks of anthropology, his views are appropriate as a critique of psychology as well.

> Attempts to understand or explain preliterate systems of belief have frequently led anthropologists to compare them with ideal 'rational' models of thought or belief; in practice such comparison has been used to separate beliefs into those which are 'rationally' intelligible and hence natural and not in need of explanation, and those which deviate from this ideal and are consequently puzzling and in need of explanation. It is clear that the form of many anthropological theories has been partially determined by the ideal of rationality adopted and in practice this ideal has usually been presented as that which is normative in the modern natural sciences, that is to say modern anthropological theory has been profoundly influenced by its conception of ideal scientific practice. This conception

has, however, been derived less from familiarity with the natural sciences than from familiarity with the philosophy of science and the abstract discussions of 'scientific method' to be found therein. British anthropologists owe little to physics or biology but much to a philosophical position steeped in empiricism, and the accounts of induction, deduction, observation and experimentation it has generated.

There has been some shift within psychology and anthropology away from such simplistic taxonomies of modes of thought. But often the change goes no further than, for example, an increased number of taxonomic categories. Thus, Bartlett, (1958) begins with a dichotomy which contrasts closed (puzzle solving) thinking to open-ended ("adventurous") thinking, and expands the second term to include everyday, natural scientific, mathematical, artistic, and (speculatively) religious and legal thinking as well. Or, to take quite a different time and theoretical orientation, Simon (1976, p. 260) comments: "At a commonsense level, most of us believe that there are differences in cognitive style among lawyers, physicists, economists, accountants, and historians. Yet there has been almost no careful work on the nature of those differences . . ." The principles behind these distinctions will be discussed shortly. But the point to be made here is that the relation between culture and cognition implied by such characterizations is not changed simply by cosmetic alterations in the categories into which different modes of thought are classified. Indeed, the principles of thinking--not surprisingly focused on modes of classification as well as logic and rationality--which have been used to characterize "civilized" or "scientific" modes of thought--have not much shifted since plucked from the common-sensical ambience by Lévy-Bruhl and his contemporaries. Negative, residual terms, such as the law of participation, mystical identity, etc., have fallen out of use. But the improvement is debatable, for the change is little more than a reduction in redundancy, since either set of terms implies the other, whether explicitly or not.

Changing terminology and taxonomies may be symptoms of real, if unorchestrated, change. Cole et. al., Bronfenbrenner and Neisser, in asserting the value of attending to cognition in everyday life, have raised questions about the exotic nature of laboratory investigations of thinking.[4] "Cultural practice theory," developed by Cole and the Laboratory of Comparative Human Cognition (e.g. LCHC, 1981), emphasizes situational variation in functionally adapted cognitive skills. This, in turn, calls the everyday/scientific thinking dichotomy into question; for their theory highlights the diversity of cognitive skills for an individual across settings. Similarly powerful and suggestive arguments have been developed within the sociology of science, especially in the work of Latour (e.g. 1980). He, and a handful of colleagues have undertaken ethnographic investigation into the practice of laboratory science, and argue the unexceptional nature of the psychological and social processes occurring therein. Goody (1977) moreover, argues that we must rethink such dichotomous classifications. And Hutchins (1980) provides a detailed analysis demonstrating that the procedures for Trobriand land disputes fall well within the categories of Western formal logic. But these efforts have not yet converged to move either psychology or anthropology to a new orthodoxy concerning the taxonomizing of high order relations between large sociocultural units and modes of thought.

Reluctance to give up the notion that there are basically two ways of thinking is accompanied by a continuing assumption that these ways of thinking are brought about by membership in social categories and groups. What started as a dichotomy between 'civilized' and 'primitive' cultures, has changed over the years, but only in the nature of the groups so designated. Basil Bernstein argues, in effect, for a substantive parallel between this cultural distinction and differences between social classes within industrial European society.[5] It is a complex argument in which socialization provides the link between class and cognition:

4

> Without a shadow of a doubt, the most formative influence upon the procedures of socialization, from a sociological

viewpoint, is social class . . . . The class system has deeply marked the distribution of knowledge within society. (p. 163).

What are these assumed (admittedly, ideal-typical) differences between social classes? They are characterized by Bernstein (1972, pp. 162-164) in by now familiar dichotomous terms. They may be summarized in the form used by Goody.

upper class	lower classes
orders of meaning	
universalistic	particularistic
explicit principles	implicit principles
freed from context	tied to context
the metalanguage of public forms of thought	tied to local relationships and to a local social structure
speech codes	
elaborated	restricted
reflexive	not reflexive
change possible	no access to self-generated change
articulated symbols	condensed symbols
(modes of thought)	
rationality	metaphor

C. R. Hallpike, who strongly argues that 'primitives' are retarded at a preoperational level of cognitive development, echoes Bernstein's public/local distinction--a social version of scientific/everyday thought--and implies class distinctions as well:

> Rather than contrasting primitive man with the European scientist and logician, it would be more to the point to contrast him with the garage mechanic, the plumber, and the housewife in her kitchen. (1979, p. 33).

Goody, on the other hand, in criticizing the set of dichotomous categories given above, does not erase the great divide, but domesticates it, by locating it within a single subject:

> The notion of a shift of emphasis from magic and myth to science and history has been the commonplace of anthropological discourse since its very beginning . . . . Another current of opinion has concentrated upon analysing the technical achievements of simpler societies and calling attention to the mythical or magical elements of our own . . . . The very existence of these two trends . . . points to the inadequacy of the notion of two different modes of thought, approaches to knowledge, or forms of science, since both are present not only in the same societies but in the same individuals. (1977, p. 148, emphasis added.)

LCHC (1981, p. 147) cites D'Andrade, (1974), Shweder (1977) and Wason and Johnson-Laird (1972), "who demonstrate that the everyday thinking of American adults has many of the properties previously attributed as characteristic of non-literate peoples."[6] Unfortunately, this argument is as likely to expand the gulf between everyday and scientific thought as to diminish it. It is difficult to avoid the conclusion that even today the domestication of the savage mind and the savagery of the domestic mind are viewed as fundamentally the same thing.[7]

If the argument so far is correct, the operationalization of "fundamental" cognitive operations in the psychology laboratory may be more one of building tasks to reflect idealized norms of "scientific thought" than of scientific, or any other, practice. This may help to account for the ubiquitous procedure by which experimental psychologists assign normative status to idealized performances on laboratory tasks when generalizations from laboratory performances to everyday practice are made.[8] Thus, Cole, Hood and McDermott (1978, p. 22 ff.) point out that, for many psychologists, everyday thinking has been viewed as simplified, less demanding, than that required in experiments. Research on the impact of limited information-processing resources on problem-solving strategies illustrates the currency of the problem. Slovic, Fischhoff and Lichtenstein (1976, p. 169) argue that

> Experimental results indicate that people systematically violate the principles of rational decision making when judging probabilities, making predictions, or otherwise attempting to cope with probabilistic tasks.

Furthermore, (p. 174):

> It may be argued that we have not had the opportunity to evolve an intellect capable of dealing conceptually with

> uncertainty. We are essentially trial-and-error learners, who ignore uncertainty and rely predominantly on habit or simple deterministic rules.[9]

They recommend reliance on scientist-experts. And despite the view that the brain has not sufficiently evolved, suggest (p. 183) that, "we need to teach people to recognize explicitly the existence of uncertainty and how to deal rationally with it." Klahr (1976) suggests that for these researchers,

> humans are unable to correctly utilize these tools /probabilistic models or game theory/ in dealing with complex problems. What do they do? Slovic and associates say they use a variety of heuristics . . . . However, the heuristics of Slovic and others . . . seem more like labels for /experimental/ paradigms intentionally concocted to elicit maladaptive behavior. (pp. 244-245).

The characterization of everyday thought as 'simpler' than that demanded in cognitive experiments or 'science,' may be questioned on several grounds. First it stands in direct contradiction to a widely held view among scientists that their goals are precisely those of reductive simplicity. Neither is adequate in my view, for relations between science and the world it purports to investigate are mutually entailed in one another. Science studies just that portion of the complex everyday world that we think we can know.

Further, the nature of rationality is at the heart of the thinly veiled equation between cognitive tasks in the laboratory and normative descriptions of empirical science. I began (p. 2) by quoting Bartlett's view that everyday thought is what happens when the thinker is not trying to be logical or scientific. But the same argument may be made about rationality as I have made about degrees of complexity of thought: that science and the everyday world are mutually entailed in one another. It follows that the same degree of rationality is exhibited by scientist and subject; the 'rational' explanation of the former depends on his assumptions about that of the subject. These define the scientist's task relationally, as one of reflecting the apparent 'rationality' or as one of reacting to the apparent 'irrationality' of subjects' accounts and explanations. The dilemmas are the same, whether the goal is comparison across cultures, social classes, or a comparison of cognitive activities in experiments with problem solving in everyday life. Perhaps the simplest way to question the value of judging thought processes by the tenets of normative empirical science is to wonder if these precepts have empirical validity as description of cognitive activity in this or any other culture. The work of D'Andrade (1982), Latour (1980) and Suchman (1980), to name empirically oriented attempts to answer such questions, would suggest not.

Second, there are compelling arguments that positive science in Western thought is, like all deep, pervasive, complex systems of belief, tautologically constructed. Polanyi speaks to this issue in cross-cultural comparative terms:

> the stability of the naturalistic system /of 'science'/ which we currently accept . . . rests on the same logical structure /as Azande beliefs in poison oracles/. Any contradiction between a particular scientific notion and the facts of experience will be explained by other scientific notions; there is a ready reserve of possible scientific hypotheses available to explain any conceivable event. Secured by its circularity and defended further by its epicyclical reserves, science may deny, or at least cast aside as of no scientific interest, whole ranges of experience . . . (Polanyi, 1958; exerpted in Marwick, 1970:337).

And third, Sahlins (1976) argues that to defend the rationality of 'irrational' rituals, as Malinowski does ('functional' for him becomes a defense of activity as rational, at least in the sense of 'sensible') is to defend the privileged truth value of 19th century canons of formal logic. Instead, Sahlins suggests, rationality is the great rationalization of Western culture. That is, 'rationality' is the principle by which we close and tautologize our own system of thought. Within its bounds is, by definition, whatever 'makes sense' to us; the rest, the residual category--including 'primitive,' and more recently everyday, thought--lie outside. The conclusion seems inescapable that if a contextually oriented psychology is to develop, both everyday thought and the means by which we describe and evaluate cognitive activity must become objects of study.

Theory and Description

Just as polar categorization of modes of thought is part of a long tradition in psychology and anthropology, the same may be said for the view that descriptive specificity, as opposed to theoretical generalization, is the fate of any attempt at a contextualized psychology. This theme runs through the person/situation debates in social psychology (e.g. Gadlin and Rubin, 1979; Rogoff, in press). Cole's thesis (1981) is that this issue has been raised in strongly parallel debates, on the one hand in late 19th and early 20th century anthropology, (i.e., between social evolutionists, Boas, and, in their turn, his critics), and, on the other hand, quite recently in psychology. The critiques of Boas (e.g. White, 1949) and critiques of context-specific approaches to cognition have much in common. As Cole argues (1981, p. 20),

> Boas' success in criticizing existing theory without being able to replace it won him many detractors who complained that he had introduced "historical particularism" into anthropology, opening the floodgates to local descriptions and trivia-mongering in the place of real theory.

He cites Jahoda's (1980, p. 126) parallel critique of the work of LCHC:

> /this approach/ appears to require extremely exhaustive, and in practice almost endless explorations of quite specific pieces of behavior, with no guarantee of a decisive

> outcome. This might not be necessary if there were workable "theory of situations" at our disposal, but as Cole admits, there is none. What is lacking in /the context specific/ approach are global theoretical constructs . . . . of the kind Piaget provides, and which save the researcher from becoming submerged in a mass of unmanageable material. (Cole, 1981, pp. 20-21.)

If a theory of situations is what is needed, anthropolcgy might be thought the place to look. But relations between psychology and anthropology have been couched in ideographic/nomothetic terms just as have been relations between Boas' work and evolutionary anthropology, and LCHC's work and stage theories in developmental psychology. Thus, Campbell (1961, p. 338) contrasts the two disciplines:

> The great difference in task must be recognized between /anthropology/ the descriptive, humanistic task of one who seeks to record all aspects of a specific cultural instance and the /psychologist's/ task of the abstractive and generalizing "scientist" who wants to test the concomitant variation of two isolated factors across instances in general.

He goes on to argue that both anthropology and psychology revolted against "the theoretical excesses of a previous generation," (p. 339) to avoid the biases which theory introduces into the objectivity of fieldwork. He stresses the shared positivist epistemology of American anthropology and psychology, but concludes that there should be a mutually respectful, though definite, division of labor.

Cole (1981, pp. 9-10) echoes Campbell's emphasis on a division of labor between the fields:

> In a certain sense, psychology and anthropology represent a division of labor with respect to explaining human nature; anthropology provides a description of the content of human experience while psychology describes the processes that interpret experience. At least with respect to their accounts of individuals, anthropology and psychology have historically played out the content-process distinctions in the construction of disciplines.

From the perspective of psychologists, then, many of whom begin with a belief in the universality of cognitive processes, all that culture _can be_ is content and/or context--an assemblage of situational particularities--and anthropology, as the discipline which studies it, is the descriptive study of those particularities. Indeed, from this perspective, the notion of the theoretical and nomothetic study of culture is at best regarded suspiciously, at worst denied entirely.

But, as I shall indicate, it is precisely these kinds of caricatures of disciplines and divisions of labor, that has led to the absence of meaningful discourse at a theoretical level between disciplines. It is also such assumptions--particularly the universality of cognitive processes--that mistake theory and theoretical discourse sui generis for a metaphysic concerning the nature of cognition and culture. That this metaphysic has a hegemonic hold on the study of cognition is intimately related to the role of positivism as the central ideological tenet of the symbolism and epistemology of Western science.

Relevance and Rigor

Very closely related to the two issues discussed so far, and the arenas in which they are played out, as I have already suggested, is that of rigor versus relevance. Campbell provides but one of a series of papers in which anthropologists and psychologists have focused self-consciously on relations between their disciplines (Köhler, 1937; Rivers, 1926; Boas, 1910; Bartlett, 1937; Nadel, 1937; Price-Williams, 1980; Edgerton, 1974; Campbell, 1961; and LCHC 1978, 1979). He sees psychology as an abstractive, scientific testing approach to the study of human activity (see p. 16), versus the descriptive recording, participant observation methods of the anthropologist. The "versus" here is ambiguous. One interpretation is that the two terms stand in a trade-off relationship with one another--one may give up a certain amount of, say, experimental control, for a certain amount of assurance that the observer's and subject's perceptions of the situation are congruent. Or, to learn about peoples' activities in the settings of their everyday lives requires suspension of laboratory control over some of the circumstances in which activity takes place. But a second interpretation better describes current research practice: that the two methods, laboratory experimentation and participant observation, in fact form another simplistic opposition, this one concerning the appropriate means of seeking truth. For, on the whole, papers about relations between anthropology and psychology have been chauvinistic on both sides, and not productive of synthesis or even communication. Edgerton (1974, pp. 63-64) suggests an explanation for this heated opposition:

> I believe that most cross-cultural psychologists are committed to experimental procedures as their ultimate means of verification . . . . Because the conflict is at the level of a basic belief about how truth is best ascertained, it is often exacerbated by unspoken assumptions . . . . Anthropologists have always believed that human phenomena can best be understood by procedures that are primarily sensitive to context, be it situational, social, or cultural. Our methods are primarily unobtrusive, nonreactive ones; we observe, we participate, we learn, hopefully we understand. We rarely experiment, and then only under special conditions. This is our unspoken paradigm and it is directly at odds with the discovery of truth by experimentation which, at least as many anthropologists see it, ignores context and creates reactions.

That is, he argues that the issues are fundamental epistemological ones concerning the nature of procedures by which we may arrive at "truth."

He emphasizes the fundamental nature of opposition between the underlying assumptions which we have glossed as "rigor" and "relevance" and warns that, "it may take a revolution in Kuhn's terms" to bring about a reconciliation of the two paradigms.

It is remarkable that papers about relations between anthropology and psychology do not call for theoretical rapproachment between the two disciplines: The level of argument is in fact almost uniformly methodological. The puzzle may be resolved by pointing out that the two fields are dominated by a positivistic view of proper social science: if theory is to grow out of empirical observation, then the place to begin a dialogue is about the methods to be used to collect the data.

But if we accept this view as an assumption on which to build an ecological psychology, we can only continue the discussion at the same old level and the result must be equally unproductive. In the terms in which it is usually couched, one method pitted against another, with feasibility as the unsatisfying criterion proposed to select one over the other,[10] the debate is, I think, unresolvable. The question must be approached not in terms of relations between method and method, but between method and theory. The difficulty is to move from strictly methodological questions or theoretical positions to their interrelations. Cole (e.g. 1981) has begun such a move by calling attention to parallels in anthropological and psychological debates about relations between culture and cognition and how to investigate them. It is a fitting topic to choose as new ground for interdisciplinary dialogue, and one object of the present essay is to move to a position in which the mutual relevance of theoretical, and theoretically-motivated methodological, concerns may be more clearly formulated.

The Coherence of Issues in Positivist Psychology

So far I have described a series of dichotomously polarized issues and attempted to demonstrate that they pervade and limit debate in multiple contexts, between schools, paradigms, and disciplines. I have yet to consider the sources of the coherence with which they reinforce one another. And it also remains to propose a position in relation to these debates from which to proceed further in discussing the work of those who have been most deeply concerned with the study of cognition in context.

First, the issues of dichotomous modes of thought, theory and description, and appropriate methodology, are exceedingly closely interrelated. They take their shape, the great divides are formed, in terms of a positivist epistemology which specifies a series of assumptions on which all three issues are based: rationality exists as an ideal cannon of thought; experimentation can be thought of as the embodiment of this ideal in scientific practice; science is the value free collection of factual knowledge about the world; factual knowledge about the world is the basis for the formation of scientific theory, not the other way around; science is the opposite of history, the one nomothetic the other ideographic; cognitive processes are general and fundamental, psychology, correspondingly, a nomothetic discipline; society and culture shape the particularities of cognition and give it content, thus, sociocultural context is specific, its study ideographic; general laws of human behavior, therefore, must be dissected away from the historical and social obfuscations which give it particularity.

I have presented these propositions as a series of links which form a chain, although they entail each other in more complex ways than here indicated. To challenge any one of these assumptions must lead to (at least) a chain reaction through the rest. In particular, the quest for ecologically valid research on cognition in context may well call into question relations between the experiencing mind and the sociocultural world, which in positivist terms obscures it directly and gets in the way of the scientist's observation of it as well (providing, not incidentally, a major rationale for the laboratory study of decontextualized mental activities). By the line of argument presented here, the question of ecological validity is a fundamental epistemological one, and its answer has far-reaching consequences.

But before pursuing this argument further, it is essential to make clear what relations between cognition and context (culture) are presupposed in the positivist formulation. The end of the "chain" presented above assumes that culture is both separate from, and stands in a hegemonic relationship with, cognition, such that apparent variation in the deployment of cognitive processes must be interpreted in terms of what 'naturally' varies--the particulars of culture and context. It is a familiar argument, popular among early social evolutionists. For instance, Chamberlain, (1901, pp. 457-58) accounted for what he supposed was the arrested mental development of 'primitive' peoples thus,

> There is abundant evidence to show that the children of primitive peoples, whatever the condition of adults may be, are quite as well endowed mentally as the children of civilized peoples, the great difference between them existing in the greater number of learnable things which the environment of the latter provides, and the care and trouble which the community takes to make the acquisition of these things possible. Not the minds so much as the schools of the two stages of human evolution differ.

The argument still has currency, having been put forward as the major thesis of a recent book:

> because the milieu of primitive societies is cognitively less demanding than our own, the cognitive development of its members will be correspondingly retarded . . . . I am therefore suggesting that the collective representations of a society must themselves reflect, . . . in their basic cognitive aspects, the level of cognitive development of the great majority of the adult members of that society.
> (Hallpike, 1980, pp. 31-32.)

Other current debates take a very similar form, including all manner of cultural deficit explanations; accounts of IQ differences by class and ethnic group, school performance differences, cross-cultural variations in stages of cognitive development, or the timing of their acquisition (as in Chamberlain, 1901, schools are seen as important factors here).

LCHC (1981) cite Spencer in making the general point that evolutionary theorists linked culture and cognition quite closely. They emphasize this assumption as a major parallel between these theorists and current debates in psychology. But it is possible to detect a more specific formulation of relations between culture and cognition in the very passages they refer to.

> During early stages of human progress, the circumstances under which wandering families and small aggregations of families live, furnish experiences comparatively limited in their numbers and kinds; and consequently there can be no considerable exercise of faculties which take cognizance of the general truths displayed throughout many special truths. (LCHC, 1981, p. 2, emphasis added.).

That is, not only are culture and cognition related, but the former is assumed to have a formative influence on the latter.

Earlier (p. 4) it was argued that classification of modes of thought implies a particular kind of relation between culture and cognition. The "Great Divide" between primitive and civilized cultures has today been replaced by something akin to compartmentalized occupational specializations. But, regardless of the social/cultural units appealed to, they imply a belief in the crucial formative role of context (culture) in the creation of modes of thought. The differentiation between modes is given in terms of the cultural-social units which are assumed to critically affect thinking.

Treating the laboratory, and school as well, as privileged contexts in which cognition takes place "out of context," has been a major device within psychology for relegating to the status of residual and implicit, issues about the interrelations of thinking and social context.[11] The positivists' separation of society and the individual underlies a belief in the feasibility of separating (in laboratory or school) social and individual components of cognition. Thus Bartlett divides social instincts from social forms; Lévy-Bruhl separates "true perception" from its socially distorting cocoon, children take 'tests,' and psychology laboratories were established to study elementary cognitive processes free of socio-conceptual contamination. But to conduct the practice of laboratory psychology "as if" sociocultural context has been dismissed, does not correspondingly remove that practice from a general theoretical position concerning relations between culture and cognition:[12] emphasis on the fundamental, uniform nature of psychological processes, with concomitant assignment of variability to cultural particulars, _is_ a position; surprisingly, one which asserts the hegemony of culture over cognition.

It has not been easy to crystallize the present argument, for as in the person-situation debate within social psychology (Rogoff, in press; Gadlin and Rubin, 1979), once the question is called, proponents of any position find it difficult to make an extreme argument such that only cognition or only culture has compelling influence on the other. It is correspondingly easy to agree, in very general terms, that all possible relations have some validity, including interaction between culture and cognition (or person and situation), or that they form an essential unity. But these very reasonable pronouncements are troubling in two ways. First, they do not establish a principled alternative theory of relations between cognition and culture (see section II). And second, they tend to be phrased as evidently reasonable, without addressing the contradiction between them and the implicit positivist assumption of cultural hegemony. The latter assumption continues to form the basis for the practice of research--for everything but general pronouncements on relations of culture and cognition.

To be unclear about the nature of relations between culture and cognition, to posit all possible relations between the two terms, or to adopt as an unexamined assumption the hegemonic nature of context-cognition relations, all lead to the use of relations as explanations, when they themselves should be the object of theoretical inquiry. A very simple principle, then, will provide the basis for the rest of the discussion: to change the terms of debate so as to avoid the dichotomous dilemmas described above, in their unresolvable forms, we must treat relations between culture and cognition as problematic--not given.

II.

CURRENT THEORETICAL POSITIONS CONCERNING THE CENTRAL QUESTION FOR AN ECOLOGICAL PSYCHOLOGY: THE LOCUS OF RELATIONS BETWEEN CULTURE AND COGNITION

As we move from a critic's to a practitioner's view of this issue, turning, now, to the papers in this volume, the goal of stipulating relations between cognition and culture may be elaborated in a series of analytic questions. 1) Are such relations to be found in the experiencing individual's mind? 2) Or are they fashioned by social interaction between individuals? 3) Could it be that they lie in a more general interaction between a sociocultural order and its members' experience of that order? 4) Or must we look to some other conceptualization of relations between the individual and the social components of everyday life? Each of these questions, of course, implies an answer, and, with it, a position on the determination of the relationship itself; that is, on the degree to which culture shapes cognition or vice versa. Each position, moreover, implies a commitment to the nature of the two constructs themselves, their uniformity and variability, and to the character of the processes by which they are articulated. It follows, too, that the first three alternatives, and presumably any other, lead to different views about the meaning and relevance of ecological validity.

These issues--of ecological validity, the nature of cognition in context and the nature of contexts of thought; the degree of uniformity and stability which they might be expected to display--are raised throughout the book, and give substance to more than one resolution to the central problem. These will be discussed later in detail. For the moment, description of the papers in the book may serve to introduce the discussion. Some authors took the tougher problem to be to capture the social and interactive quality of cognitive development in context. This approach draws generally on Vygotskian concepts, especially the zone of proximal development (see Newman, Griffin and Cole; Greenfield; Rogoff and Gardner; Ginsburg and Allerdice; Lubin and Forbes; and Wertsch, Minick and Arns, for examples), and the notion of the active learner, developing through the construction of social interaction with the teacher, parent or other caregiver. Other authors have focused on relations beteen everyday activities and conventional psychological categories of cognition, i.e. those traditionally operationalized in laboratory tasks. They explore activities in daily life, often those of adults, in the settings in which they routinely occur. Here problems include how to conceptualize relations between context and the target cognitive activity; and what, within the multilevel complexity of such activities, are appropriate units of analysis (see chapters by Scribner; Mehan; Fischer, Burton, and Brown; Lave, Murtaugh and de la Rocha, for examples).

Taken as a whole, the papers demonstrate a strong insistence on moving only as far, theoretically, as new empirical demonstrations will provide an evidential base. Though there are fascinating exceptions (Greenfield's study on learning to weave; Scribner's on commercial dairy loading; Mehan's on decision making processes for placing pupils in special classrooms and Fischer, Brown and Burton on learning to ski) most of the papers draw their cognitive subject matter from the traditional corpus of experimental cognitive tasks (a memory task, arithmetic skills, early language learning, constructing a puzzle, making combinations of pairs). Yet

the data are more richly contextualized than in the models from which they depart. Multiple methods for obtaining and analyzing data are the rule, and include combinations of experimentation and observation, testing, protocol analysis, and analysis of videotaped observation sessions. More often than not, this research references, and sometimes investigates directly, more than one setting, and task performances are compared across settings or across people with different relations to those settings (e.g. clerks and dairy loaders, or "novices" and "pros").

Conceptually, there are some general points of agreement among the authors: individuals are more notable for their flexibility and diversity as thinkers and actors than as uniform reflectors of stages or styles. There is general agreement with Barker's demonstration (1963a) that different people often act similarly within a setting, and vary dramatically across settings. Correspondingly, there is high agreement that development is to be understood in terms of the units in which everyday settings and activities co-occur in daily life. Finally, there is serious effort among the authors to develop theory about the nature of context, or setting, though relations between this problem and that of cognition-culture relations, are not viewed uniformly.

The Contrasting Cases of Dialectical and Ecological Psychology

The approach taken in this book is not the only one currently directed at developing a psychology-in-context. The life-span developmental movement (dialectical psychology) provides an instructively contrasting case. It conceives of 'development' as a lifetime enterprise, and assumes the social, especially historical, nature of personhood and the impact of sociohistorical context on the specific nature of the developing individual (e.g. Gadlin and Rubin, 1979). This approach emphasizes change as the rule in life development; stability, be it over a life span, a phase of life, or across only a short stage of development, being the exception.[13] It follows that less emphasis is placed on continuity than on discontinuities within the life cycle, as well as between generations growing up in different historical circumstances.

into "ecology" here (& perhaps add a f.n.

There are similarities between the two genres of research: both dialectical & ecological & assert the necessity of incorporating mental activity and its context in a single framework.[14] Both begin with the active subject interacting with a changing world; and correspondingly they reject conventional assumptions about uniformity and stability of cognitive activities across time and/or across situations (cf. Cole, 1981, on cross-cultural developmental research; Gergen, 1980, on Piagetian and other stage theories of development). They likewise share an interest in the social and historical context of psychology as a discipline. This last, which does not seem at first glance to be compellingly entailed in the shared characteristics of dialectical and ecological psychology requires explanation. There is also another, different, puzzle concerning the dialecticists' and ecologists' shared interest in change and context: these should surely lead to a coincidence of analytic questions, units of analysis, theoretical concerns and methods as well, but such is not the case. I shall address this last issue first.

The ecological psychologists take as the central "given" a pair of elements--cognition and culture--and have struggled to develop a principled theory of their relations. Beginning with these elements involves an assumption that they are 'out there,' to be observed and measured. So it is not surprising that first steps in establishing relations between them have been characteristically empirical ones. The dialecticists[15] start with a relation--dialectics--and face the problem of conceptualizing the terms to which the relation applies. As an abstract premise, independent of the terms which it is supposed to relate, it gives a theoretic-programmatic character to their approach. The varied manner in which ecological psychologists conceive of, and investigate, relations between culture and cognition will be discussed below. Here, I will focus on corresponding problems within the life-span movement, in specifying its fundamental units, be they of mind, experience, the individual, or a social transaction.

Indeed, the dialectic is characterized almong life-span developmentalists almost as variously as the authors attempting to define it. Kvale (1977), who is unusual in specifying a position, a materialist dialectic one, in this case, describes it as follows:

> Dialectics focuses on development and interaction and studies the internal relations between phenomena that exist as aspects of a totality. These relations involve contradictions between aspects mutually implying and excluding each other. The focus is upon the qualitative development of phenomena, of one quality changing into another. Dialectics is the concrete study of concrete relations, investigating psychological phenomena in their internal relations to a broader social and historical totality. Thinking and action are two internally related aspects of man's practice in the world . . . . Dialectics emphasizes the interdependence of man and world, of the observing subject and of the observed object. Men act upon the world, change it, and are again changed by the consequences of their actions. The contradictions of men's thinking and action are to be traced to the contradictions of the material basis of society, primarily to the modes and relations of production (pp. 165-66).

Meacham, on the other hand, argues (1977, p. 278) that his transactional model of memory is dialectical because it "emphasizes change rather than permanence"; "not only the individual, but also the memories and the cultural-historical context are derived as products of the transaction," and relationship between the individual, memories, and context is one of reciprocal causality. But the terms of this dialectic are not material, nor is the individual conceived of as an integral whole--memories and the individual are treated as separate terms of a dialectical relationship--standing in conflict with Kvale's version of dialectics. These differences have not been brought into confrontation with one another within the life-span developmental movement.[16]

The concept of dialectical relationship is quite frequently reduced to nothing more than reciprocal causality, but this is criticized even within the life-span movement. Buss (1979b, p. 330) comments:

> There has been a lot of loose talk within the life-span developmental literature about the individual-society dialectic as involving mutual or reciprocal determination--each influences and is influenced by the other. Yet such a conception provides no rationale for understanding the concrete direction of both individual and historical development.

Buss's critique is both well taken, and, in my belief, a central problem too often passed over by his colleagues.

The dialectic, however conceived, is employed by dialectical psychologists in relating many different sets of terms. White (1977) explores dialectical relations between theory and method; Buss (1979) has taken the dialectic to apply fundamentally to the individual in relation to society; Gadlin and Rubin (1979) propose two dialectical relations, one between social structure and psychological theory, the other between social structure and psychological reality. But the priorities, and relations between them, are not the subject of analysis (see also Datan's (1977) critique of Riegel's broad application of the relation).

Dialectics is, in short, a program, not a theory. Further, the dialecticists value the very general nature of dialectics cum world view, or general orientation: some, e.g. Baltes and Cornelius (1977: pp. 121-122, p. 130-131), because they are reluctant to move away from a positivist view of science, yet are dealing with a relation which is not easily submitted to rigorous data collection and analysis as they conceive of it. Others, e.g. Kvale (1977, p.166), emphasize the programmatic character of dialectics because, for a materialist, theory is an epiphenomenon of concrete forces and relations, and hence only a general reflection, not an analytically generated accounting, of them.

Units of Analysis Contrasted: History and Culture

The units of analysis proposed by the two groups stand in contrast with one another. The relation-focused, programmatic dialecticists take the central unit of analysis to be the historical event developing in its historical context. For the ecological psychologists, empirically oriented, it is individual activity in a space-time context, or 'activity setting.' There is no reason why historical events and activity settings should not be essentially identical specific units of analysis, which to be sure, might be analyzed in different ways. But the programmatic character of life-span dialectics does not encourage examination of specific activity settings. It typically leads to the treatment of history as an independent variable,[17] which, in fact, does not meet the conditions of either the dialectical or ecological approaches to units of analysis; it also leads to descriptions of historical forces on a very large scale (e.g. "the Protestant Ethic," or "inner- versus other-directed," Gadlin and Rubin, 1979, p. 233). These last are similar to, and sometimes overlap with, evolutionary models of culture (both Bronfenbrenner, 1979, and the dialecticists, e.g. Reese, 1977, draw on Soviet evolutionary/historical models, e.g. Luria, 1976), which also take the unit of analysis to be very different in its order of magnitude to that envisioned in the "concrete study of concrete relations between individuals" (Kvale, 1977 p. 166; quoted above, p. 29). Neither constricted operationalization nor sweeping historical vision are conducive to the pursuit of coincidence between units of historical context and units of cultural context.[18]

There is further evidence that such a coincidence is unlikely. There is a familiar positivist opposition (e.g. Sterns and Alexander, 1977, p. 111, describe Riegel's recommendation that there should be more emphasis on history, less on culture) between the diachronic focus of the historically oriented dialecticists, and the ecological psychologists' emphasis on situation and synchrony. And while ecological psychologists acknowledge the generally historical nature of social and individual development (e.g. Wertsch's, in press, account of Soviet psychology makes this point vividly), in practice, the empirically unamenable nature of historical processes results in their omission from specific consideration. Thus, the ecological psychologists, with an ideology similar to that of many anthropologists, stick to their detailed observations, whose 'scientific' merit is not in question, but which place them squarely in the synchronic camp. Conversely for the dialecticists, operationalization, of an enormously reductionist variety, becomes their only empirical recourse, given their predicament as historicists committed to a positivist ideology of 'science.'

The divisions between the two approaches are not simply a matter of positivist ideology, but of history as well. The manner in which both life-span developmental psychology and ecological psychology have gradually taken on coherent identities suggests that general principles are at work. Each began with a methodological issue that gradually took on the character of a theoretical one. Thus, according to Sterns and Alexander (1977, p. 110), the dialectics movement began with a concern for lack of congruence between cross-sectional and longitudinal data:

> The research designs of Schaie and Baltes did not explicitly come out of a particular scientific theory or approach. In fact, much of the discussion was directed at assumptions made about developmental change in an empirical atmosphere. These approaches were attempting to understand developmental change and what factors affect it. The lack of congruence between cross-sectional and longitudinal studies was the impetus.

Dialectics represents the theoretical transformation of this issue. It is consistent with the empirical orientation of the ecological psychologists that cognitive variation across specific activity settings should take on the role of central problem. For it began with ecological validity--a methodological critique of laboratory experimentation--as a problem in generalizing about cognitive activity in other settings, especially those of everyday life. It may well have been given impetus by difficulties encountered exporting laboratory experimental paradigms to cross-cultural research situations (e.g. Cole, Gay, Glick and Sharp, 1971). The ecological validity issue has gradually been transformed into attempts to build a situated, contextualized psychology (as the papers in this volume attest). The parallels do not seem accidental: leaving the positivist tradition is, almost by definition (see pp. 20-21), a matter of transforming into theoretical problems what are viewed from within as methodological ones.[19]

Both approaches stand today as, at least, specialized critiques of positivist psychology. The ecologists' concentration on methodological criticism (although at a high theoretical level--see below) and the dialectists' critical stance towards the theoretical assumptions of positivist psychology, reflect the history of each movement, the units of analysis which they have taken to be fundamental to their respectively programmatic/theoretical and empirical approaches, and to one further factor, the more or less radical character of their separation from mainstream psychology. The dialecticists take a self-consciously "revolutionary" position, and are correspondingly explicit in their (historically oriented) criticism of positivist developmental psychology.[20] Gergen, for example, argues:

> It appears that the life-span movement, if it may be so called, has begun to emerge as a vital revolutionary force. At stake is not simply an alteration or expansion of theoretical perspective but rather the entire positivist tradition of developmental psychology (1977, p. 136).

Given their commitment to empirically grounded change, the ecologists take a less abruptly discontinuous view of the project. We will come back shortly to the question of why, in fact, both have moved to higher order views of the problems they address, given that neither was motivated by theoretical issues at the outset, and that the ecologists, at least, do not now take their mission to be a theoretically revolutionary one. But first we must consider in turn how each conceives of methodological and historical/critical problems.

On methodological issues, the dialecticists barely acknowledge either the shortcomings of existing research methods (other than their limitations in relation to longitudinal perspectives), or the potentially radical implications of their theoretical position for a corresponding methodological position. Thus, Baltes and Cornelius (1977) insist on the compatibility of dialectics with standard 'scientific' methodology and claim that dialectics determines methodology no more than it does theory. Sterns and Alexander assume that,

> The goal of scientific explanation is the determination of necessary and sufficient antecedent conditions for the occurrence of events. Manipulative experiments are the

> major tool for examining the validity of assumed causal relationships (1977, p. 114).

Kvale makes an ingenious argument about relations between laboratory and other settings, but does not challenge experimental methodology:

> Discarding the laboratory studies of list learning in favor of remembering in natural environments need not imply a reliance on subjective impressions and anecdotes. It is precisely the well-controlled /school/ examination situation, where the natural world has become adapted to the experimental laboratory . . . that should secure experimental rigor. (1977, p. 186).

Other than passing comments like these, the issue of ecological validity appears not to warrant attention in the view of the dialecticists.

What characterizes the ecologists' focus on this problem is an insistence on placing methodological criticism in a theoretical framework.[21] Bartlett (1932) provides a historical charter for the enterprise; more recently Cole, Hood and McDermott (1978), and Bronfenbrenner (1979), as well as papers by several authors in this volume. These critiques of the sufficiency of laboratory experimentation as a base for generalization about cognitive activities, have two dimensions. First, Bartlett (1932, Chapter 1) argues that asocial exploration of cognition is a contradiction in terms. He proposes an iterative strategy for research in which observation of everyday activities in context would form the basis for the design of experiments whose results would, in turn, inform further observation. Most authors in the present volume have adopted strategies much like that advocated by Bartlett; this research is characterized by an order of analysis in which data are assessed in relation to the paradigmatic limitations of the procedures used to obtain them, often involving comparisons of the data obtained under different sets of procedural constraints (e.g. papers in this volumes by Scribner; Lave, Murtaugh and de la Rocha; and Newman, Griffin and Cole). Second, higher order critiques of methodology also focus on the social context and implications of laboratory experiments as a class of activities-in-settings in and of themselves. LCHC (1981) reviews literature on psychological experiments as social phenomena (see also Bronfenbrenner, 1979, p. 123).[22]

Both dialecticists and ecological psychologists have taken an unusually strong interest in the history of psychology, including cognitive development.[23] But the historical interests of the two genres differ. Thus, the dialecticists, separating themselves from a conventional paradigm of development, generate critiques of positivist psychology.[24] The ecologists, on the other hand, tend to focus their reflexive examination of psychology in two directions--on the past, in an effort to revise (and establish?) their 'roots,' and across paradigms (not an unexpected strategy for veterans of cross-cultural research), in search of additional theoretical and empirical support. The very widespread interest in Soviet psychology is an apt illustration of this point.[25]

The interest of the dialecticists and ecologists in the history of their discipline stands in some contrast with that of psychology in general. Whether originally intended as such, or not, I believe it to be a consequence of a more fundamental shift: changing the relation of cognition and context (historical or cultural) from the status of a "given" to an object of inquiry. Such a change challenges conventional positivist wisdom, and provides a basis for historical inquiry as well. For the notion that the relationship between cognition and history (or culture) is truly problematic has powerful recursive and reflexive implications. By very definition, the analysis of this relationship is itself a function of the conjuncture of cognition and cultural-historical circumstances; it, too, has a context, and thus is itself an object of inquiry. This, of course, stands in sharp contradistinction to its exclusion from positivist psychology, a tradition which lacks any sense of its own context or constitution, and of the problem of reflexivity. The dialecticists' interest in the sociohistorical context of psychological research appears to be directed towards achieving a paradigm shift (see Danziger, 1979; also Meacham, 1977, p. 275; Baltes and Cornelius, 1977, pp. 127-128), while for the ecological psychologists it is simply a part of practice; but in both cases it follows from shared questions concerning relations between mind and its context.

Neither the revolutionary approach of the dialecticists nor the ecological psychologists' more evolutionary approach, avoid serious difficulties: the self-conscious assertion of a new paradigm by the dialecticists appears to place disproportionate weight on criticism of existing positions, and high level pronouncements about theory, without establishing an integrated methodology which generates empirical studies that reflect this integrity.[26] The ecological position, less clear about its differences from conventional psychology but insistent on empirical grounding, maintains richer ties within psychology, risking, however, unprincipled eclecticism. What is more, ecological psychology fares little better than the life-span movement in coming to terms with social theory (see fn. 24). And it tends to produce discontinuities between a theoretical position, whose implications are more radical than it acknowledges, and its existing empirical investigations.

How different the two positions appear depends on the perspective from which one evaluates their respective focus on history and culture. In positivist terms, they would seem irreconcilably opposed. But other views (e.g. current positions on relations between anthropology and history such as Comaroff, in preparation) argue the essential unity of these perspectives. For present purposes at least, we may take the pursuit of historically situated cognitive development and culturally situated cognitive development to be but a single problem. I am not, however, proposing a synthesis of dialectical and ecological positions. Relations between culture and cognition are, in my view, dialectical in nature. But this joining of features characteristically associated with ecological and dialectical positions is not sufficient to establish a coherent position. To reiterate the general point that has been made all along, what is required is to anchor the (theoretically principled) terms of a dialectical relation in a social-theoretical position which gives them specific form and meaning. It remains to be seen how ecologists and dialecticists approach the analytic questions raised at the beginning of the section; it is to these problems that I now turn.

The Individual and the Social Order: Functional and Phenomenological Views

We must begin by addressing the different conceptions of social order and the relations of individuals to that order, if we are to end by locating the articulation of culture and cognition.[27] Two positions have some currency, but not in equal proportions, within developmental psychology. The first is a normative functionalism, based on the positivist assumptions described earlier; the second is a phenomenological position, directly antithetical to the first, in which the social order is conceived of as emerging in the interactions between social actors. The latter is considerably less salient than the former, but still important; for the major form of theoretical innovation within ecological psychology today consists in attempts to produce a viable combination of the two positions.[28]

Normative functionalism, whose full blown version in Parsons goes back to Durkheim, and before him to Comte, describes the way in which society, and relations between the individual and society, are conceived of in positivist psychology. In its barest terms it has already been sketched in section I. Society is conceived of as a normative order in place,[29] that is, external to the individual, having a separate (and for research purposes, separable) existence from the individuals who pass through it. Individuals become actors by incorporating its roles and norms. Change in the character of a society is conceived of as an evolutionary matter requiring sweeping time spans; history and biography are, thus, irrelevant, when the scope of investigation is a portion--or even all--of the human lifespan.

If culture is viewed as the evolutionary accumulation of knowledge, increasingly complex technology and social forms;[30] mind and culture are viewed as but two aspects of the same phenomenon a view attributed by LCHC (1981; see also Kvale, 1977) to most of the last century of developmental theory. It should not be surprising, then, to find metaphorical characterizations of memory as storehouse, or warehouse, or attic (Kvale, 1977)--the repository of a lifetime's accumulation of (the culture's accumulation of) knowledge.[31] Memory takes on the character of a place where 1) cultural acquisitions are stored, and 2) development toward increasingly integrated and general knowledge and rationality are to be expected. The difficulty with this view is that the nexus of cognition/culture relations is never constructed in the present, but always assumed to have an existence because of events which took place in the past. "Warehouse," "toolkit," or "knowledge storage" metaphors for memory make it possible to abnegate the investigation of relations between cognition and culture by, in effect, defining culture as "what people have acquired, and carry around in their heads," rather than as an immediate relation between individuals and the sociocultural order within which they live their lives. In practice it has meant that developmental and cognitive researchers have been able to proclaim the important role of culture in cognition without looking beyond the standard unit of analysis: the "cognitive processes" of a particular individual in response to a laboratory task.[32]

In developmental theory, as well as in memory research 'the acquisition of culture' is often used as a general gloss for the process in question. Giddens (1979, p. 129. See also fn. 29), in a discussion of societal reproduction, and hence, of theories of socialization, comments that,

> We have to recognise that 'becoming social' cannot be understood in 'monological' terms: as a series of competencies simply 'stored' in the learner.

He cites Bruner (1974) as an example in which development is conceived of as a set of "stored competencies." This view depends upon the metaphorical location of cognition/culture relations in the past, and as an accumulation. Clearly, there are parallels between models of memory and of development. In short, when society is conceived of in normative functionalist terms, an internalized version of the society-out-there is invoked as the mechanism by which sociocultural order impinges on the internal consciousness of individuals. But this approach provides no basis for accounting for relations, especially generative relations, between people-in-action and the social world around them.

Attempts to Integrate Functional and Phenomenological Views

At the beginning of this section I suggested three possible specific answers to the central question: that one might locate relations of cognition and culture in the mind, in social interaction, or in relations between a social order and individual experience of it. On the basis of the present discussion it appears that there may be only two; for locating relations of culture and cognition in the mind is exactly the solution which emerges when cultural transmission or socialization is assumed as the mode of relations between the individual and society. The third and first solutions must thus be combined into one. What of the second alternative, locating relations of culture and cognition in social interactional constructions?

A phenomenological approach, far from conceiving of society as a system in place, independent of the individual, is one in which the social order is taken to be an artefact of socially constructed interactions between individuals. Society, coterminous with the set of dyadic relations which make it up, may exist as a set of reified, archetypal ideas, intersubjectively constructed, but not as an independent set of material and social structures and processes. But to account for broadly shared norms and beliefs requires an awkward tour de force of assigning special properties to certain kinds of interactions. The functionalist position suffers from the difficulty of accounting for the discontinuity between individual and social order. The phenomenological position enjoys continuity between socially-relating individuals and the society they interactively construct. But correspondingly, it is unable to account for macro-social, political-economic structures which seem not to be creatable or negotiable among individuals.

Not clear ??

There have been various attempts to come to terms with the dilemmas inherent in what is, after all, a general problem within the social sciences as a whole.[33] One attempt to avoid either extreme position is to be found in Bronfenbrenner (1979). He presents both models of the individual in society, a phenomenologically based one in which a series of concentric levels of context (micro-, meso-, exo-, and macro-systems of development) encompass the individual who is their focal point. The other is a functional model of roles, activities, and relations between roles, to be learned by, or moved into by, the developing individual. But he does not explicitly confront the contradictions between these viewpoints.

Luria, Vygotsky, and Leontiev share a Marxist functionalist view of relations between the individual and the social order and in varying proportions a social constructionist position. (Vygotsky, especially, foreshadows current views within ecological psychology.) One aspect of this position is the hegemonic deterministic role of the material/social order vis-a-vis the individual.[34] Luria, a founding figure in cross cultural psychology, expresses this view, one which pervades both Russian ~~and~~ cross cultural genres of research (see fn. 29):

> Psychology comes primarily to mean the science of the sociohistorical shaping of mental activity and of the structures of mental processes which depend utterly on the basic forms of social practice and the major stages in the historical development of society. (1979, p. 164).

Leontiev reflects a functional model of relations between society and individual, most especially in his division of social and individual analysis into two separate modes. He, and before him, Vygotsky, take as a broad assumption, based on the Marxist underpinnings of the theory of activity, that activity within and by the individual is possible only in relation to an analytically prior social/material world. As Leontiev, quoted by Wertsch (in press, p. 6) puts it

> The analysis of activity . . . comprises the decisive point and principle method of scientific cognition of psychic reflection, consciousness. In the study of the forms of social consciousness it is the analysis of social life, characteristic means of production, and systems of social relationships; in the study of the individual psyche it is the analysis of the activity of individuals in given social conditions and concrete circumstances that are the lot of each of them.

Vygotsky's analysis of what he calls "the zone of proximal development" is problematic in similar ways. It is a cultural transmission model (although the process of transmission is conceived of in social interactional terms--I shall return to this shortly). Like other cultural transmission models, it provides no basis for accounting for relations between activity and sociocultural structures, for like the aphorism that "life is what happens while you are planning it," this approach treats social order as what a child internalizes through a process of interaction with a tutor, rather than as what is going on in the increasingly varied and rich settings in which the child increasingly participates.[35]

If, however, Vygotsky assumes a social order in place, he develops a detailed theory of cultural transmission as an active interactive process rather than as a passive introjective one. The social, interactive, nature of most learning processes (according to Vygotsky's views, and those expressed in this volume as well) provide children with specific support so that they can perform, initially, activities which they may not understand. Moving through an activity repeatedly, and with sensitively graded support at different stages of understanding, leads children to acquire knowledge of the goals and general framework of the activity and its relations with other activities, in adult terms.

This orientation leads to a potential solution to the problem raised by Giddens concerning Piaget's work, which assumes uniformity at the level of social order writ large. Perhaps the most successful and durable aspect of Piaget's developmental approach is his analysis of processes by which the infant's interaction with the environment, in however, an analytically undifferentiated social world (see fn. 29), leads the infant to acquire motor skills. In this vivid, prototypical example, and deeply embedded in the theory itself, is a temporal perspective on cognitive development, summed up in the question, "How does the child grow away from being an infant?" The Vygotskian approach likewise has one of those extraordinarily pithy and prototypical examples: tutor and child interactively bringing about a shift in knowledge from interpsychic to intrapsychic plane, within the child's zone of proximal development. It changes the fundamental question of development to, "how does a child grow up to become an adult,"[36] and requires a shift in focus from the unfolding individual, to the individual developing toward adult competence, knowledge and skill in a complexly differentiated social world. The Vygotskian approach, therefore, differs from functionalist positions discussed earlier, by taking the social world to be a complex, highly differentiated framework for individual activity. Given Vygotsky's emphasis on social interaction as the basis of internalization of the adult-world-in-place, the active participation of the novice in the process of learning and developing must be a basic feature of explanatory accounts of development.

It is now possible to specify the particular kind of relations between functional and phenomenological positions in Vygotsky's work, and by extension, in most other attempts to combine them, as well. He begins with an encompassing functionalism, which establishes internalization as the mode of relation between society and individual. Within this framework he elaborates a phenomenological theory (moving away from a strict functionalist position) of the process of internalization. The ecological psychology perspective follows from these views, and as we shall see, develops them further; especially the work of Cole and the Laboratory of Comparative Human Cognition, to which we turn next.

The goal, for Cole and his colleagues, is to create a single science of psychology in which the distinction between laboratory and life, between theory and experience, ceases to organize psychologists' activities and theories. From their attempts to pursue the study of cognition in everyday settings Cole and his colleagues arrive at the position that ecological validity is a relation between theory and method, and conclude that:

> if laboratory models preclude the operation of principles essential to the organization of behavior in non-laboratory environments, theories and data derived from the laboratory cannot be used as a basis for predictions about the behavior of individuals once they leave the laboratory . . . . Our own self-conscious attempts to contrast laboratory and non-laboratory settings where individuals engage in remembering, thinking, and attending activities suggest that important principles operating outside the laboratory are missing from current experimental procedures, and consequently, from current cognitive theories. In so far as our observations are correct, they provide the basis for our suggestion that ecological invalidity is an axiom (albeit an implicit axiom-in-practice) of current cognitive psychology. (1978, pp. 2-3).

Cole and his colleagues have developed "cultural practice theory" in response to this assessment.

Cultural practice theory clearly differs from the conventional view that a general theory of context-specific development is a contradiction in terms (see Section I, pp. 15-18). For LCHC appears to have no difficulty conceiving in nomothetic terms of the situationally specific nature of cognitive development. Indeed, it is assumed as a cornerstone of the theory. Thus,

> Cognitive development is characterized by the mastery of context-specific knowledge about the world. (1981, p. 104).

and

> The kinds of contexts that children spend their time in are the fundamental units out of which cognitive development is constructed. (1981, p. 99).

The major theoretical challenge, given this assumption, is to account for how cultures organize the 'next steps' of cognitive development, *within* the specific contexts which make up a culture's repertoire of contexts. Their solution may be summarized: Cultures select the contexts that in turn shape children's cognitive development,[37] organizing children's access and frequency of access to them, and arranging their experiences of patterned co-occurrence of contexts. But 'contexts' are not only, or even primarily, developmental in their functions. Rather, in keeping with the focus on the world into which children develop, they are first of all the varied contexts of cultural practices, the norm-governed systems of activity engaged in on pervasive, customary terms by all members of the culture. This is an "ecological constraint," or cultural hegemony, argument, but one in which the social order acts on the contexts of situation-specific development, rather than acting in a uniform manner upon individual role-players.

Since, in LCHC terms, "contexts" are integral to cultural transmission, it should not be surprising (see p. 50), that they are given a phenomenological interpretation along with the transmission process itself.[38] Thus, LCHC extends Whiting's (functionalist) model of social order, in which economic pursuits and social structure determine the distribution of adult activities, according to the customary division of labor, closely tied, in turn, to the settings people frequent. But:

> Missing almost entirely from Whiting's formulation of context selection and development is a description of the "interpretive procedures" (Cicourel, 1973) that are necessary to account for how people interpret rules in social situations, recognize the social circumstances they confront, and otherwise answer the question, "When is a context?" (LCHC, 1981, p. 101).

For LCHC, contexts, in which cultural practices take place and children develop knowledge and skill, are constructed by their participants, and they are "complicated interactional events." (1981, p. 101). 'Events'--socially assembled situations, the fundamental contexts for activity (1981, p. 98)--are the basic units of analysis in their theory.

What of the transmission process by which cognitive development occurs within specific contexts? According to LCHC, it is "the socio-historical school of Soviet psychology which explicitly connects ideas of interaction with the concept of development." (1981, p. 104).

They give a new form to Vygotsky's zone of proximal development, equating it with "the contexts organizing the social to psychological transformation of thinking," (1981, p. 105), and conclude, "from the socio-historical viewpoint, a culture maximizes its impact on a child's development by providing regulative contexts which fall within the zone of proximal development." (1981, p. 106).

They, themselves, point out a major difficulty with their own position: while it easily accounts for variability in peoples' knowledge, skill, etc., from setting to setting, context-specific development theory does not immediately suggest the mechanisms by which continuity and cognitive generality are brought about. They reject a learning transfer model as the "spontaneous application of analogies among remote contexts" (p. 122), and argue that, as a matter of course, people use past experience to conduct present behavior. In their view, however, this is very much a socially organized activity. Thus, "transfer is arranged by the social and cultural environment. . . . Overlap in environments and societal resources for pointing out areas of overlap are major ways in which past experience carries over from one context to another." (p. 124). Across contexts, generality of individual activity, including mental activity, is, then, primarily a social, rather than individual, phenomenon. They sum up their views,

> In fact, the massive redundancy and repetitiveness of learning situations minimizes the occurrence of new situations. In those unusual circumstances when people are

> confronting new situations, the physical features of those environments, the social distribution of social knowledge, and the presence of a number of cultural resources,. . . assist, providing bridges between contexts. (p. 128).

In sum, the LCHC position has focused serious attention and debate on many of the crucial elements of what may become a consistently principled theory: they stress the integrally social nature of cognitive development, within specific contexts, in a diversified, complexly structured world, along with the social organization of 'cognitive' generalization. Furthermore, their contradictory views of relations between social order and individual experience--such that society (or culture) selects contexts and provides the 'standing rules' for cultural practices, on the one hand, while contexts and cultural transmission are characterized as emerging in social interactional processes, on the other--help to capture an important point. While it would be better framed within a consistently principled theory, it nonetheless incorporates crucial features of the lived-in-world: people do act reflexively upon their own contexts, practices, and norms; and on the one hand they respond to a world in place, while on the other hand, they help to create it.

Analytic Questions and Answers, So Far

To sum up this section, let us return to the questions raised at its beginning. One concern was to delineate the changing nature of the concept of ecological validity, given varied general theoretical positions concerning the location of culture/cognition relations. On occasion, the banner of 'ecological validity' has been taken as a call to pursue the study of contexts of human behavior in their own right, uncontaminated by cognition. Alternatively, the term has been used to label a methodological critique which argues for more socially relevant content within unchanged strategies of laboratory experimentation. The attempt to separate the socially relevant world from the experimental laboratory is not brought into question; "pure (socially relevant) cognition" is the target. In fact, the 'pure context' and 'pure cognition' views are two sides of the same dualistic view of society and mind, and both are found in positivist functional approaches to cognitive development (e.g. Barker, 1963b, 1968; Barker and Wright, 1955, on the one hand; Carroll and Payne, 1976, on the other).

The eclectic view most current in ecological psychology does not provide a crystallized position on the nature and meaning of ecological validity. Nonetheless, within the work of LCHC and others, there is emerging some general agreement: Integral relations hold the experiencing individual and the contexts of that experience in reflexive relations which have recursive properties. Far from the idea of pure cognition or context, this view requires cognitive activity in context, in its immediate and participant-generated forms, to be the essential unit of anlysis. And, because of its recursive properties, an ecologically valid analysis must take as an assumption the contextualized nature of every level of explanation of cognition/social activity.

Further, in this view it seems obvious that the nature and meaning of 'ecological validity' is supplied by complex relations between theory and method. This stands in contrast with the positivist/functional position that it is merely a methodological question. Whatever the origins of unease with conventional views of cognitive development, the issues have recently matured into comprehensive ones of encompassing approach or problematique.

In all the discussion about relations between society and the individual, it would be easy to lose sight of the purpose of that excursion, namely, to trace the differing character of relations between culture and cognition depending upon the location of such relations within the broader theoretical terms of the constitution of society, the individual and their relations. The functionalist position, positing a social order in place and individuals molded and shaped into performers of the normatively governed social roles and practices of the society, locates relations between culture and cognition within the mind of the experiencing individual, in memory and in past accumulation of socializing experiences. Thus, the first and third alternatives suggested at the beginning of the section result in the same solution to the central problem.

The second (phenomenological) position, if my argument is correct, has consistently been subordinated, in practice, to a more general functional view of cognitive development. In spite of attempts, such as that of LCHC, to locate relations between culture and cognition in intersubjective relations, culture and cognition are, in the end, seen as aspects of a single phenomenon--knowledge systems or domains, located within the accumulating past of the developing individual. That is to say, the first three positions, in practice, are all reducible to but one, the first.

In recent work of the ecological psychologists the character of the world which individuals experience has undergone conceptual transformation in ways that hold promise for pursuing developmental theory beyond its functionalist limitations. But further progress requires further conceptual change. One problem arises from equating culture and cognition. These terms can only be treated as aspects of a single phenomenon if located at a single nexus in the social world. There are two possible nexes, of which the first is heavily represented among developmental and cognitive psychologists: 1) if culture and cognition are collapsed into representations in the mind, the concept of 'culture' is simply transformed into that of 'knowledge,' and culture may be dispensed with altogether; or 2) culture and cognition may be located together by transforming them into a superorganic system of meaning, in which case structures, language, etc., become reified constructs, but cognition, as an individual generative process, drops out of the equation. Neither appears to offer a satisfactory solution.

The functionalist position rests more often than not on a merging of what are generally thought of as cultural phenomena into the concept 'knowledge.' It results, correspondingly, in the treatment of the term 'culture' as if it referred to some large, bounded social entity (e.g. Bronfenbrenner, 1979; LCHC, 1981, frequently employs phrases such as 'the culture selects contexts . . .' Indeed, the unitary view of cultures goes back at least to Wundt: see Leach 1957, pp. 121,126). Yet large social units are usually labelled by a term equivalent to 'society' in other social science traditions. In psychological usage, the terms 'culture' and 'society' are used interchangeably to refer to a generalized, but residual, social world "out there." One unfortunate consequence of these confusions of analytic categories is to reduce any unit of analysis which insists on the integral nature of individual cognition and its context, to a component, a literal subunit of the cultural/social entity at its largest, leaving no basis for disentangling the sociocultural order and the individual's experience of it. (See below, section III.) And it also seems likely that further conceptual elaboration of these categories is not possible so long as the culture-knowledge-society terms are used in the fashion just described.

The eclectic functional/phenomenological positions have concentrated on better conceptualizing the micro-manifestations of higher order sociocultural structures and processes, asserting their diversity without assuming the theoretical task of providing a principled account of it. That culture and cognition are both taken to be variable; that they mutually affect each other, are clearer principles in this position, than the nature of the units themselves or of the higher order contexts within which persons-act-in-context. But to say they mutually affect one another ("reciprocal causation," in the dialectical literature; "mutual influence," "reflexive," "mutually constraining," or "mutually transforming" in the ecological literature) is not to specify the nature of the relation but only to affirm that it exists.

Having, hopefully, come to a clearer sense of the strengths of existing positions, and a more sharply specified sense of the difficulties which remain, I shall lay out in the following section a fourth conceptualization of relations between the individual and the social components of everyday life.

III.

THE DIALECTICS OF COGNITIVE DEVELOPMENT IN CONTEXT

If individual behavior is not a determined product of the socio-politico-economic order; if culture is not simply the product of human interaction; and if existing eclectic positions do not escape internal contradictions, there does exist one position which avoids substantial difficulties in all three: a dialectical theory in which the socio-material order and the experienced, lived-in-world mutually constitute, reproduce and transform one another. This alternative draws together the indisputable, but one-sided, claims of the first two positions, and provides the principled relation between culture and experience which the eclectic position has established as a crucial goal of the enterprise.

It may be helpful to begin with a few basic principles, and short illustrations. (1). A dialectic is not merely a declaration of reciprocal effects by two terms of a relation upon one another. Thus, to say that item displays in supermarkets influence shopper choices, while shopper choices affect how the store displays products, may imply causal relations between the two, but not a dialectical relation. (2). As I construe it, a dialectical relation exists when the terms of the relation are created, are brought into being, (only) in relation with one another. For instance, in front of the noodle display, the intention to demonstrate good shopping procedures leads a shopper to search the display, visually and physically, in selective ways; the display is arranged so that size relations and brands are salient categorical possibilities, in relation to, or against which, the shopper might structure the demonstration. Neither exists, as accessible experience or context, without the other. (3). The production of activity-in-setting is not a static, repetitive process, but must be assigned substance and meaning in such a way as to include the possibility of mutual transformation as well. Scribner's (this volume) dairy loaders provide an example. They may well begin their careers using literal solutions to dairy order problems, but the context of stacked cases containing cartons of various sizes transforms the structure of categories for describing orders. The solution procedures are transformed as well, into "non-literal" solutions. This in turn changes the salient interrelations of full cases, partially filled cases, and different categories of dairy items in the cold storage locker, in the loader's experienced version of it. Or in Weight Watchers, learning enough to prepare simple meals within the parameters of the program, acts as a curriculum which, when mastered, is both precondition and motivation for further change: the creation of more complex culinary accomplishments. (4). Mutual constitution and transformation of the terms of a dialectic need not be symmetric: the supermarket is a highly structured public place, within which the proportions of shaping of the articulation between activity and setting may well be weighted on the side of the public institution. In the kitchen, the reverse may well be true. (5). And finally, a well-specified dialectical theory must make explicit the proportions of the relations of each in the constitution of the other. We shall return to this point shortly.

To comprehend the constitutive nature of dialectical relations as they are here intended, may require a revaluation, a shift of connotation, for notions of 'change,' 'creativity' and 'innovation.' A positivist functionalist orientation is likely to mislead; for its static equilibrium assumptions, (even in the field of cognitive development), have made change and innovation into indicators of exceptional mental performance--e.g. "reasoning beyond the information given," "learning transfer." The dialecticists begin with the more compatable view that the flow and flux of unfolding activity is the sine qua non of everyday experience. It would be a mistake, then, to interpret the constitutive character of the dialectic as an exaggerated claim for the creative human spirit, or indeed, its opposite. Instead, it is an attempt to express the integrally contextualized, historical nature of human experience.

This, as it stands, is just a program, for I haven't yet stipulated the terms, the proportions or the possibilities for transformation of the dialectical relation between culture and cognition. To do so requires that this relation be anchored within a principled view of the social order and the place of individual experience in it. It was argued earlier (p. 41), that the act of assuming relations between culture and cognition to be problematic is a recursive enterprise. If we begin, then, with the assertion that culture and cognition are dialectically related, we may go on to assume that this relation propagates throughout the system, being central to relations between individual and society as well as to the culture/cognition nexus within it.

How the terms of the higher order dialectic are to be characterized is as crucial as the fact that it must be done, if the goal is to produce a theory rather than a "world view" or vague "orientation to research." There are, as we have seen in discussion of the dialecticists, many possible dialectics, ranging from idealist to materialist, Hegel to late Marx; the variety of terms to which they may be applied is limited only by one's enthusiasm. Further, particular versions of such a dialectic have differing implications for cognition-in-context, depending on the terms and particular substance of these relations. Thus, a Marxian historical materialist view of society, in spite of its vision of society as "in process," is, in relation to the individual, a social-material order in place, with hegemony over individual consciousness, determining what the individual will internalize in the course of socialization--the basis, for example, of functionalist Soviet psychology.

There is at present intense debate (see fn. 33) in the fields of history, anthropology and sociology about these issues (e.g. in history the work of Braudel and E.P. Thompson; in anthropology Bordieu, Terray, Meillassoux, Sahlins, Comaroff, Althusser; in sociology Worsley and others.) This is not the place, nor am I adequately prepared, to deliver an essay on comparative social theory. Nonetheless, the position of each of these theorists has implications for the nature of individual action and experience, some more closely reflecting the central tenets of ecological psychology than others. In particular, the early superorganic, idealist views of Sahlins (1976--but see his later formulation, 1981, for a position more compatible with ecological psychology); the historical structuralism of Althusser, Terray and ostensibly Meillassoux; and any materialist position, which by its nature must assume the hegemony of culture, although such a position need not be as extreme as that of the Althusserians, cannot, I think, provide the dialectical theory of society which will reflect the ecological psychology position. Sahlins' (1981) position, and that of J.L. Comaroff (1981, 1982, in preparation), do offer promise. The latter approach, for example, has the effect of placing normative and phenomenological versions of the nature of social order in dialectical relation with one another, thus providing one resolution to the "Great Debate." In this theory, the social and material relations of the everyday, lived-in world compose one term of the dialectic, thus,

> In formal terms, this dialectic has its genesis in the dualistic character of all historical systems, which exist at two analytically distinct levels. On the one hand, they consist in the social and material relations which compose the everyday lived-in world of any society, a world of appearances that represents itself, in the consciousness of

> experiencing individuals, in the form of substantive rules and relationships, values and interests, constraints and conflicts. On the other hand, behind this lived-in world lies a constitutive order. The latter subsists simultaneously as a semiotic system, a cultural langue, of signs, symbolic oppositions and categorical relations, and as a set of organizational principles which structure the material and social universe, its component productive and political arrangements. (Introduction, Capitalism and Culture in an African Chiefdom: A Study in Anthropological Dialectics. In preparation. p. 16).

It is not, however, a functionalist view of the world, for these

> underlying structures . . . which . . . shape the realization of relations in the "real" world, relations of production, of sociality, of domination or equality . . . have the capacity to produce a wide range of such forms; but, in so doing, they are themselves the object of reproduction and/or transformation. (p. 17).

As might be expected, the current equation in psychology of cultural phenomena with 'knowledge' and the term 'culture' with bounded social groups, must be substantially revised if congruence with this dialectical theory is to be possible. In the first place, in a dialectical theory in which the two terms of the dialectic are sociocultural order and the lived-in universe, analytic separation ceases to be the major mode by which 'culture' and 'society' are related. Instead, this dialectical theory takes as crucial the mutual entailment of semiotic system (culture) and organizational principles of the material and social universe (society). Together they create a sociocultural order; neither has analytic, or any other, meaning in isolation from the other.[39] To add to the contrast between this position and the existing analytic categories of ecological psychology, it must be emphasized that semiotic systems cannot be equated with 'knowledge,' partly because such systems are emphatically generative, while the latter concept is ambiguous on that issue, and is often used to connote bodies of knowledge, facts, etc., rather than principles for constituting those bodies or producing or extending them. And, like language, a semiotic (cultural) system cannot be equated with that partial subset of it located in the minds of individual actors. That this is consonant with the intentions of ecological psychology should be obvious: the basic principle in ecological psychology--the integral nature of the organizational form of a 'context' and the intentional activity with which it is mutually constituted--is reflected, in the dialectic proposed here, in the mutual entailment of systems of categories, meanings and symbols, on the one hand, and the organizational forms to which they give meaning, and within which they take on meaning, on the other. The generative capacity of systems of meaning is a necessary aspect of any conceptualization of active actors engaged in constructing the world in which they live as well as responding to it.

Further, the active and interactive character of actors in sociocultural contexts, and the complications introduced by the reflexive and recursive nature of their activity, is part of what is intended by the dialectical relationship between sociocultural order and the experienced world. Thus,

> it seems to me that the cornerstone of a truly dialectical approach is to be found in Marx's much-quoted dictum that "people make their own history, but they do not make it exactly as they please." For this dictum presupposes that social practice is of human making, and has an effect upon the world; it has consequences, both intended and unintended, for the realization, reproduction and transformation of manifest social and material forms . . . . Yet it does not occur in a vacuum since, in order to take place at all, social practice requires a constitutive order in place to give it both meaning and impulsion. (In preparation, p. 22).

Earlier, I suggested that one problem with existing theory in ecological psychology is the equation of contexts, or sometimes actors-doing-in-context, with subunits of the society (or culture). The dialectical theory stipulates a set of complex relations between individuals' experience of the lived-in-universe and the sociocultural order with which it is mutually constituted. Certainly the one can never be taken as a subunit of the other, and the theory provides a basis for "disentangling the sociocultural order and the individual's experience of it" (see p. 59). Thus,

> the organizational principles which compose constitutive orders will be seen, by their very nature, to be inherently contradictory. As a result, they not only impinge on subjective experience as an assemblage of conflicting values, but also demand action upon the world. In short, they motivate social practice and, by virtue of their simultaneously semiotic character, impart meaning to it; to be sure, it is in terms of such meaning that intentional activity is contrived and ideologies constructed. Social practice, in turn, fashions concrete relations among living individuals, groups and classes. As such, it becomes the vehicle through which the manifest arrangements of the lived-in world are realized; arrangements which, demonstrably, either reproduce or, under specifiable conditions, transform the constitutive order itself. Herein lies the historicity, the internal dialectic, of local systems: in so far as their underlying structures motivate--in the double sense of 'impelling motion' and 'attributing meaning to'--individual experience and social practice, they shape the realization of relations in the "real" world . . . (pp. 16-17).

Indeed, it is through a process of disentangling--and reframing--relations between sociocultural order and individual experience that a more complex view of individual categories of experience may be developed. Thereby it becomes possible to differentiate the ecological psychologists' unit of analysis, person-doing-in-context, with respect to the representation and motivation of experience within the individual, and with respect to the nature of the contexts within which people act. Let us consider them in order.

Comaroff and Roberts (1981), in a detailed study of dispute processes among the Tswana of Botswana, develop a particular model of this activity, which, as the authors suggest, has broader implications for the understanding of human activity in context, of many varieties in many cultures.

> Every sociocultural system, we submit, constitutes (1) a set of normative terms within which interaction may proceed and be rendered meaningful, (2) the values and utilities to which such interaction may be addressed, and (3) the ideology in which they are expressed. It is, therefore, in the totality of relations between these elements of a lived-in order that the logic of dispute--and, indeed, the logic of all social processes--must ultimately reside. The attribution of analytical priority to either norm or utility, then, inevitably reduces the nature of social experience and its systemic construction to a shadow of its intrinsic complexity. (1981, p. 241).

In such a system, ideology is a refraction of culture, growing from the individual's necessarily partial experience of local manifestations of the sociocultural order. Structural contradictions, ideology and conflicting values motivate social practice, norms are not prescriptive rules, but resources for fashioning meaningful accounts of experience. All of these concepts--ideology, values, social practice, and norms as resources--are analytic tools of a dialectical psychology, with which to examine the contexts of activity-in-context; that is, they may be useful employed in the multi-level recursive analysis such a theory implies.

Second, 'context' cannot be adequately conceptualized, either as 'social interaction within which cognitive activity occurs,' nor as a weighted list of components (e.g. participants, objects, space, time, etc., such as Barker proposes, 1963b; 1968). Instead, 'context' may be thought of as a relation between the two components of the dialectic, viewed in their transformation downwards to the level at which structures and meanings articulate with experienced activity. Thus, sociocultural order shapes arenas, the relatively public and obdurate aspects of particular settings such as classrooms or supermarkets, and through activity-in-setting, individuals negotiate a personal version of the arena, 'the setting' (see also Lave, Murtaugh and de la Rocha, this volume). The point to be made about both individual experience and its contexts is that relations--among systems of meaning, ideology and norms; between arenas and settings of activity--are as complex and important as the terms they link. In taking this point as fundamental, it is possible to imagine the beginnings of a truly social psychology in context.

In such a theory, culture and cognition are conceived of as analytically distinct but mutually entailed in one another. Relations between culture and cognition are located in other relations: in that between immediate experience and the refracted cultural resources of meaning; in that between the organizational structures of arenas and the experientially generated settings of everyday activities; finally, in synthesis, in activity-in-setting. The question of stability or flux of cognitive activities across settings cannot be raised directly in a dialectical approach. It must first be transposed from a question about the individual, to one about activity-in-setting as the appropriate unit of analysis. The answer begins with the assumption that both stability and change are necessary aspects of all human activity-in-setting. Treating either stability or change as the more fundamental is not a matter which awaits empirical investigation, for they are not observable phenomena, but complex relations between the flux of experience, and the structural order and cultural meanings in relation with which that experience is constituted. It is precisely the proportions and relations between stable and changing aspects of activity-in-setting on particular occasions that provide challenges for analysis, and the possibility of moving beyond platitudinous generalizations.

The implications of this theory differ from those of a functional or functional-phenomenological position in other ways as well. There is space here to illustrate only a few: issues of learning transfer, problem solving, and the conceptualization of memory. It has already been suggested (pp. 43-44) that conventional models of memory and of culture *cum* knowledge reflect positivist-functionalist assumptions about the separateness of mind and society, and the siting of culture/cognition relations within memory. Likewise, the standard conceptualization of knowledge as a set of tools stored in memory, transferable from one situation to another without interactional or situational constraints (cf. Goody, 1977; Cole and Griffin, 1980; Gick and Holyoak, 1980; and Kvale, 1979), depends fundamentally on a positivist view of relations between cognition and culture, society and the individual. In the dialectical psychology proposed here, where setting and activity, including cognitive activity, mutually constitute each other, knowledge is conceived of as located in the process of reproduction of activity-*in*-setting. It would be a contradiction to then assume the importance of learning transfer, either as a process of analogic reasoning *across* settings, or as the ultimate test of learning. This is not, however, to deny the existence, or theoretical and practical importance, of relations between knowledge, activity or setting as constituted at one point in time, and any of them at other points in time. Recent findings by LCHC, Rogoff and her colleagues, and Ginsburg and Allerdice are compatible with a dialectical approach and suggest possible avenues for reconceptualizing the problem of cross activity-setting continuities. LCHC (1981) emphasizes the organizational structuring of contexts and their relations (see p. 55), which provide continuity in individual experience in addition to that brought to situations by individuals. Rogoff and Gardner (this volume) present evidence that mothers teach their children which other contexts to reference in a new and unfamiliar one. Their findings point to the relevance of ideology and normative resources in creating continuity between experiences; Ginsburg and Allerdice, this volume, in their work on the disjunction between arithmetic systems used in home and school, suggest the role of ideology in producing discontinuities of experience as well. The dialectical theory synthesizes these perspectives: there are structural, symbolic, material and ideological relations and divisions among activities and their contexts; these relations and divisions probably rarely (possibly never) have their initial constitution at the micro-level assumed in experimental studies of learning transfer, but rather, are constituted at much higher levels of recursive organization of activity-in-context.

Nor are intersituational continuities likely to be generated by the mechanisms assumed in traditional learning transfer experiments. Thus, arithmetic algorithms may seem perfectly general, and hence perfectly transferable, under the assumption that there are no constitutive relations between arithmetic activity and the contexts in which it takes place. But such algorithms are in fact rarely seen in supermarkets, where their effort and execution requirements are disproportionately large. Instead, in supermarkets setting-activity relations are structured in ways that lead to other highly successful, but not content-sparse algorithmic, kinds of arithmetic interactions. (See Lave, Murtaugh and de la Rocha, this volume). It follows that arguments about modes of thought--general or specific; abstract or concrete--have no predictable relevance in the approach to cross-setting relations proposed here. These considerations may help to account for what I take to be consistently negative findings in the experimental literature on learning transfer (e.g. from Thorndike, 1913 to Gick and Holyoak, 1980). It also opens avenues of research that I find promising.

The chunk size of discrete tasks in learning transfer, and other cognitive experiments, has traditionally been "a problem to solve." This is but one factor which helps to explain why problem solving, which in commonsense terms seems a rarity, is nonetheless a powerful metonym for cognition in present day psychology. It may be partially explained by the custom of calling on disembodied culture, in the form of knowledge domains, as the basis for generating experimental tasks, for this leads, in particular, to "problems" to be solved rather than contexts to be negotiated. It certainly violates the integrity of the unit of analysis, activity-in-setting, common to both ecological and dialectical positions. Further, "problem solving" is a pervasive characterization of cognition as one of a set of interrelated concepts which place types of psychological functions in temporal relation with one another. Thus, when culture/cognition relations are displaced to memory, the 'repository of past experience,' problem solving acquires the character of present activity, whose major function is to operate on knowledge-in-memory to produce prediction and control (solutions to) events to come.

But in a dialectical psychology, remembering is conceived of as activity in the present, and knowledge as a social production which is constituted, reproduced and/or transformed in context. It is inseparable, functionally, from other aspects of activity. From this perspective, "problem solving" ceases to be an appropriate metonym for cognitive activity as a whole. Loosely put, the typical predicaments in life are rarely of the "first day newcomer" variety. And the probability of adapting to such an exotic setting by analogic problem solving (using analogies generated at the chunking level of grade school arithmetic word problems) must be rather small. Instead, the common predicaments of everyday life are, above all, mundane; they are familiar and repetitious; they result in "boredom" (too successful an adaptation through repeated experience in context); that, and the irritations of reoccurring, unresolved snags are the order of the day. This too, of course, is a skewed view of everyday life, for at the levels at which it seems routine, it simultaneously gives the impression of encompassing the generation of an endless variety of changing minutiae. Both views have legitimacy: the generative nature of experience makes of boredom an experience marking situations as wholes; at the same time it recreates or transforms old snags, and in the terms of dialectical theory, is the inevitable manifestation of motivated social practice. I am proposing, in sum, that in a dialectical theory, relations among memory, context and cognitive activity might better be described as "experience-generation," rather than problem solving.

These have been exceedingly condensed and bare sketches of ways in which a dialectical ecological psychology reformulates notions about relations between the uses of the mind and the settings in which such uses are dialectically constituted. There remain two issues raised earlier in this section, the first concerning the possibility of transforming dialectical relations between activity and setting. In a dialectical theory, the reproduction of activity is a process-in-context, a matter of active classification and ideological assertion of similarity, repetition or routine. What is reproduced and/or transformed is not knowledge, but activity-in-setting. Both activity, specifically cognitive activity, and setting (though not arena in any direct way) are in a sense normally in a state of transformation upon which an interpretation of 'reproduction' is exercised by most people much of the time. I think the challenging problems are, first, to try to understand the essential nature of those processes for which we have the commonsense label, "routine." That is, reproduction is in some sense more problematic and less easy to understand than transformation, in the kind of analysis proposed here. Second, it would be useful to address the relations that lead us, in one framework of time and activity grain-size, to characterize our lives in terms of routine, and in another, to characterize them as essentially in flux.

The second parameter of the theory, required to move it from the realm of program to theory, is the stipulation of proportions of relations in a dialectic between sociocultural order and the experienced world of individuals. I believe that the proportions change in relation to the particular construction of context (the relation between arena and setting) on the one hand, and in relation to the motivated intentions of activity of individuals, on the other. This addresses the proportions of activity and setting in dialectical articulation at the levels at which individuals experience it, but does not succeed in addressing the ultimate level of articulation between a lived in world and its sociocultural order. This cannot be a simple sum across contexts, but is a historical process of the utmost complexity. Indeed, all it is possible to do here is to suggest one unit of analysis, activity-in-setting, to which we may appropriately (and must ubiquitously) address the question.

Having reached the limits of my present understanding, and exceeded the normative limits for introductions, it is appropriate to conclude, and to do so by returning to the question with which we began. Why study 'everyday' cognition in social context? At its most general, the argument is intended to make self-evident the proposition that there is no other kind. For, each active individual in contexts whose social practice shapes and is shaped by the constitutive rules and structures of the sociocultural order, is the experiencing individual who plays out an inescapably quotidien existence in the lived in universe (be it in the service of science, dairy loading, growing up, or some combination thereof). Although the implications of a dialectical theory of relations between cognition and culture have been but suggested in the course of this introduction, the chapters in the book may be read and interpreted as grounded possibilities, pointing in the same direction.

Notes

*This book took shape through a workshop sponsored by the Society for Research on Child Development under the auspices of the Foundation for Child Development. Barbara Rogoff provided the initial topic and the enthusiasm and effort to get the project underway. The workshop itself, March 1981, was what such an event is supposed to be: one in which each of us learned from the attention bent upon our work by all the others. And there emerged a sense of common roots and goals which were there before the workshop, but unidentified. On sabbatical leave in 1981-82 there was time to approach the introduction as an assessment of the field in broad, general and future-oriented terms. The National Institute of Education provided financial support (Grant NIE-G-81-0092). The Center for Human Information Processing at UCSD provided support for the work and encouragement to write. Extensive conversations with Barbara Rogoff were very important in developing the form and content of the introduction. I also wish to thank Dorothy Holland, Sylvia Scribner and Michael Cole for their help, but such a bare statement cannot convey the rich and varied impact of their thinking on my work. Michael Murtaugh and Olivia de la Rocha, likewise, have continually pressed my thinking in new directions, in conversation and in response to their work. John Comaroff has been intellectual catalyst and extraordinarily supportive critic. More specific acknowledgement of my debts to him, and my long and continuing debts to Michael Cole, are evident throughout the text. I am very grateful to Kathy Alberti for the professional and personal manner in which she has prepared the manuscript.

[1] This section draws on a wide range of sources, across time and across subdisciplines within psychology and anthropology. There is not space, nor am I prepared, to present the argument in finely drawn historical terms. But the scope of the discussion is nonetheless intentional: I believe the issues under critical examination here are enduring commonalities in the study of thinking since it began the transition "from its long past to its short history." (Danziger, 1979, p. 28.)

[2] Horton (1973, pp. 253-254) also calls attention to this lacuna in Lévy-Bruhl's work.

[3] The scientific/primitive and scientific/everyday dichotomies dissolve in the work of Boas (e.g. 1911), as he moves to a position that people use their cognitive capacities primarily to rationalize existing social custom, after the fact. That these two changes occur together supports the claim made here concerning their mutual dependence.

[4] A major source of experimental task construction in cognitive, cross-cultural and developmental psychology has been the positivistic folk psychology of rationality. Issues of rationality itself, higher and lower level explanations and generalizations, hierarchical versus low level multiple classifications, concrete versus abstract 'thinking' are dimensions frequently built into experimental tasks. To document this properly, I am aware, would be to rehearse the history of experimental psychology.

[5] And coming full circle, Mary Douglas, an anthropologist, has applied (1973) Bernstein's taxonomy of elaborated and restricted speech

codes, to differences in cosmology and ritual among whole cultures, rather than social classes.

[6] The coexistence of the two modes of thought in a single culture has motivated anthropological theories about non-Western societies as well. Parsons (1957) suggests that Malinowski's functionalism was a response to the dilemma created by his assumptions that the 'savage' was both rational empiricist *and* a serious believer in the efficacy of ritual. "There is a sense then in which Malinowski's central problem was to make both types of behavior humanly understandable to the modern European through a theory of function of some sort. Above all an adequate theory had to account for the fact that both types of behavior characterized the same people under different circumstances." (pp. 54-55).

[7] The present introduction is an initial attempt to lay out the issues, which are far more complex than the simple identity traditionally accorded them in the anthropological and psychological literature. They will be developed more fully in a forthcoming monograph, *The Savagery of the Domestic Mind*.

[8] A further point which need not be labored here is the hypothetical nature of the enterprise. One major thrust of the papers in this volume is to make laboratory and other settings the object of parallel investigation. (See also, Bartlett, 1923, p. 284; Lave, in preparation.)

[9] According to Kuhn (1962), exactly the same is true of scientists, which supports recent sociology of science findings about the practice of science.

[10] Consider both Bartlett and Simon in this regard: The first half of Bartlett's treatise on thinking (1958) provides detailed reports on a handful of puzzle solving tasks in the laboratory. The second half covers enormous territory--everyday thinking, experimental science, and artistic thinking, with topic and data in inverse proportions to those of the first half of the book. "All I can attempt is to select a few illustrations, and to put forward in a general way, and without detailed evidence, certain conclusions which may help to establish some important relations . . . between the tactics and aim of everyday thinking and those characteristic of thinking in the closed system, and in experiment." (p. 166.) Simon (1976, p. 264) likewise recognizes "how little direct evidence is available about the second-by-second, or even hour-by-hour, course of the decision process," and advocates descriptive studies of the complex practice of cognition in the everyday world. But he refuses the challenge to address these questions either descriptively or experimentally, on feasibility grounds: "I am in no position to cast the first, or even the second, stone at social psychologists who have retreated to the 'social psychology of one,' for I have retreated even a step further into individual cognitive psychology. I have rationalized that retreat with . . . two arguments . . .: the greater cost-effectiveness of individual studies and the reductionist argument that nothing more may be needed." (p. 265.) For one of several critiques of Simon's position, see Mehan, this volume.

[11] Neisser comments (1976, pp. 2-3), in confirmation of this claim, "The conception of human nature held by the classical introspective psychologists was inadequate . . . . Narrow, overly rational, applicable

only to laboratory situations, it lacked any clear account of how people interact with the world."

[12] As Samelson (1974) notes, in his critique of positivist psychology, "To reject metaphysics does not guarantee the non-metaphysical nature of one's position; to proclaim the end of ideology may itself be an ideological move." (p. 228.)

[13] Cf. Gergen (1977) for an extreme version of this position, but the principle is so widely subscribed to in some form that it needs no special documentation.

[14] Siegel, who, with White, may be the only part-time contributors to both dialectical and ecological endeavors (e.g. Datan and Reese (1977) and the present volume), comments, "I agree wholeheartedly with Kvale that Bartlett's . . . emphasis on remembering as an activity occurring within a changing sociohistorical context is a critical one, and an emphasis frankly missing in psychology (until recently)." (1977, p. 193.)

[15] The following discussion of the dialecticists draws disproportionately from Datan and Reese (1977), because of its particular concentration on dialectics.

[16] For a third view see Baltes and Cornelius (1977, especially p. 125). Yet another unresolved contradiction may be found in a comparison of Gergen's (1977) work with that of Buss (1979b). The former rejects "the central positivist assumption that social knowledge can be accumulated across time" (p. 136), while Buss espouses the opposite view that "the way toward making sense out of the individual-society dialectic . . . is to frame it in the context of ontogeny recapitulating phylogeny." (p. 330).

[17] One empirical example, of a handful, is Glen Elder's work on the effects of the Depression on children from different socio-economic strata. But this study, by Bronfenbrenner's account (1979, p. 266 ff.), at least, appears to reduce "the Depression years" to a few independent variables--e.g. light versus heavy stress on families. Such work may demonstrate that history 'counts,' but not what history, or how. The problem is more general in the life-span developmental movement: rather than developing theory concerning history, culture, or the interrelations of these social phenomena with individual experience, they tend to simply operationalize the former two respectively, as "generational-cohort differences" (history) and "time of measurement" (culture), see Sterns and Alexander (1977, p. 111).

[18] Indeed, if the dialecticists can be taken to task for matters of scale, so may the ecological psychologists, who tend to reduce development to minutes--or hours--worth of activity.

[19] White (1977, p. 62 footnote) observes the methodological nature of borrowing between schools within psychology, which underscores the thesis here.

[20] There is not, of course, complete agreement on the revolutionary nature of the enterprise (see, e.g. Baltes and Cornelius, 1977, p. 122).

[21] And this reflects a break with the standard positivist construal of methodological problems as only that. More often than not, concerns for ecological validity are expressed as a pro forma call to 'tinker' with experimental methods. Neisser comments on the exasperatingly programmatic character of many quick pitches for ecological validity--"Like so many admonitions to virtue, it emphasizes the superior

righteousness of the moralizer without giving much guidance to the moralizee" (1976, pp. 33-34; see also Siegel, 1977, p. 192). Another unsophisticated view is embodied in the contradictory claim that conventional, rigorous laboratory experiments can go on as usual, while making the content more ecologically valid. Thus, Carroll and Payne (1976) talk of the increasing social significance of their subject matter, while assuming that it will continue to be explored in experiments 'simulating' real world situations. White and Siegel, this volume, take Bronfenbrenner to task on these grounds. The 'tinkering' position consistently treats the problem--and its solution--to be matters of the practical conduct of experimental research.

[22] However, Bronfenbrenner continues to treat 'ecological validity' as a *methodological* issue; indeed he treats it as an ideal, unobtainable in principle. This places him in the position of arguing that a "little" ecological validity is better than none at all. Perhaps this difference between his views and those of most other ecological psychologists (which border on rejection of much of the experimental literature), helps to account for, on the one hand, his reliance on social-psychological research from the heyday of "big experiments," and his silence on the work of those who have considered the issue in theoretical terms--Barker, Bartlett and LCHC among others.

[23] Among the dialecticists, historical contextualization of the research enterprise is an explicit and valued principle, Buss, a pioneer in this respect, edited *Psychology in Social Context* (1979a), which includes critical/historical papers by among others, Gergen, Samelson and Riegel. It also includes an excellent paper by Danziger, who, while not

a life-span developmental psychologist, makes their general case about relations between theory and its social context eloquently. Among the ecologists, Cole's work (e.g. 1981) traces parallels between 19th century anthropology and present debates in psychology; White (1976, 1977) has a long term interest in the history of psychology; Scribner's recent paper (in press) on Vygotsky's use of history also reflects this interest.

[24] Two substantive critiques include Gergen (1977) on developmental theory, and Kvale (1977, especially pp. 174ff.) on memory research. Their theses are, respectively (1) Gergen (pp. 144-148): Stage theories lend themselves to knowledge construction in the positivist mold, and a view that development is reliable and replicable. He opposes to this his theory of aleatory change. (2) Kvale: "Empiricist and positivist psychology has tended to regard mental life as the manifestations of some ahistorical and asocial inner entities" (1977, p. 178). "Current memory research often involves a transformation of a socially determined remembering activity into a thing or to fragmented and anonymous processes taking place in some inner mental apparatus from which the remembering subject disappears" (p. 179). He top, suggests an alternative model, which will be discussed shortly, but his position generally emphasizes the interdependence of consciousness and behavior, subject and object, persons and the world in which they live (see p. 166).

[25] Cole has edited Soviet Psychology for many years. With S. Cole, he edited a book by Luria (1979); Vygotsky (1978), was edited by Scribner and Cole among others. Scribner's paper on Vygotsky's uses of history has already been mentioned. Bronfenbrenner has published on child development in the Soviet Union (e.g. 1970), Wertsch as well, producing numerous papers and a recent book (1981); to name but a few.

[26] One further problem is that of insularity. The life-span developmentalists compose a remarkably tight network of self-referencing, co-publishing scholars. The most serious drawback of this stance is the isolation of their speculations about relations of history, society and in turn, their relations to individual experience, from the theoretically sophisticated literature already existing in the social sciences. The literature, as well as the task, is enormous; to recreate it, or worse, recapitulate its development, would be absurd. This problem, hopefully only a temporary one, born of a short history and a long list of things to accomplish, plagues not only the life-span developmental movement, but the ecological psychologists as well.

[27] Psychologists obviously do not consider their role to be primarily that of social theorist. But an argument parallel to Samelson's (1974) on metaphysics and ideology is appropriate here: Any psychology implies a theory of society's relations with the individual--even if it is (only) implicit.

[28] Some of the dialectical psychologists take a functional position (e.g. Reese 1977, p. 216ff.;Schaie, according to Sterns and Alexander 1977, p. 112). Sterns and Alexander, Buss, Meacham and others, emphasize, but only in programmatic terms, the reciprocal relation between individual and environment, rather than assuming cultural hegemony. Though limited, there is more discussion of these issues among the ecological psychologists, and I shall not pursue the dialecticists' views on relations between society and the individual further in this essay.

[29] The uniformity posited (in this brand of functionalism) for society, in its relationship with the individual, should be evident. Bronfenbrenner provides an example: "The macrosystem refers to the consistency observed within a given culture or subculture in the form and content of its constituent micro-, meso-, and exosystems, as well as any belief systems or ideology underlying such consistencies" (1979, p. 258). Anthony Giddens, a social theorist whose major concern has been to mediate among the great sociological traditions argues, however, that "it is clear that much work on the psychological development of the individual is deficient as an account of socialization, in so far as the overriding focus is upon the differentiation of personality within an undifferentiated 'society.' This is true also in some considerable degree of the theory that has long dominated child psychology in respect of cognitive development: that associated with Piaget." (1979, p. 129.) LCHC makes a similar point in relation to cross-cultural research on the development of cognitive styles: "Berry offers analyses at both the individual and cultural levels of analysis. Or so it appears. However, when one considers the nature of the independent variables it is quickly apparent that with two exceptions, *the same independent variable codes must apply to all subjects within a cultural group*. (1981, p. 59, emphasis his). I have omitted consideration of cross cultural psychology in this essay precisely because, in taking cultures as units of analysis, it assumes cultural hegemony over cognition and the undifferentiated nature of individual experience within the social world, and appears to have little to contribute, therefore, to the current debate.

[30] While I intentionally separate society and culture it appears that such is not the custom within psychology (see below).

[31] Gergen (1977) takes the positivist tenet of 'accumulation' as the major target of his critical efforts, but replaces it with a model of flux so extreme that it denies the possibility of theory development.

[32] This is not the only possible temporal framework for a theory of memory. At leat one of the dialecticists, Kvale (1977), has rejected this model. He equates memory with consciousness, by locating the process of remembering in the present. Memory, then, is a process of refraction through present experience, of continually transformed versions of past experience. Overlaid on conventional metaphorical models of the 'memory as toolkit' variety, it would follow that remembering must continuously distort the 'objective content' of experience. But treated, instead, as an activity in the present, remembering becomes a set of relations among experiential processes, and relations among those relations, integrally shaped and motivated in the present. To anticipate section III, this theory of memory appears to locate relations of cognition and culture in complex relations between the individual and the world in relation with which experience is constituted. Some such approach may be required for a theory of cognition in culture. It also looks promising in that it seems to break down dichotomies which are unavoidable when culture is construed as 'something which happened'; mental representations in the individual as subsequently abstracted and generalized.

[33] It has been characterized by Worsley (1981) as the Great Debate in current anthropological and sociological disputes on the nature of

relations between individual experience and the social order. This suggests the timeliness of present concerns within ecological psychology, and recommends a broad interdisciplinary prespective as we pursue them.

[34] Kvale, too, adopts this position. In general the dialecticists' enthusiasm for Russian psychology seems based on a narrow reading of their similar emphasis on change and history rather than on a broad understanding of the functional character of Marxian analysis, on the one hand, and recent trends within Russian psychology, on the other. The latter seem to be moving towards finer and finer levels of analysis of cognitive operations through laboratory experimentation (Wertsch, in press); Lomov (personal communication) complains that "activity" has become a mere synonym for psychological process as in conventional usage in American psychology.

[35] See White and Siegel, this volume, and Barker and Wright (1955) for elaboration of this latter view of development.

[36] Leontiev, at least, shares this view: Bronfenbrenner (1977, p. 284) describes a conversation in which the former commented, "It seems to me that American researchers are constantly seeking to explain how the child came to be what he is; we in the U.S.S.R. are striving to discover not how the child came to be what he is, but how he can become what he not yet is." White and Siegel, this volume, express a similar point of view.

[37] Here they intentionally contrast their position with the typical eco-cultural approach in which development consists in "the ever present molding of behavior by the accumulated contingencies of history and geography" (LCHC, 1981, p. 100), a standard functionalist position.

[38] Certain characterizations of cultural practice theory make it appear to be first, and most basically, a phenomenological approach to development. Thus, "A cultural practice theory of culture and cognition resists the separation of individuals from the environments in which they live their daily lives. This means that culture and cognition represents neither a purely subjective (in the head) nor purely objective (in the world) phenomenon; it is an intersubjective phenomenon, to be found in the interaction between people." (LCHC, 1981, p. 103). "'Culture' and 'cognition,' then, refer jointly to behavior assembled by people in concert with each other." (p. 104). Yet elsewhere they take an encompassing functional position and reserve intersubjective construction as an explanation for the process of socialization. In my view this dual representation of their position is more accurate than the phenomenological one. (See below.)

[39] The isolation of cultural meaning systems from their contexts has been common in psychology; 'disincorporated culture' (in both senses of that term) has long been and continues to be, a problem for cognitive anthropology as well.

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Section III

THE DIALECTICAL CONSTITUTION OF ARITHMETIC PRACTICE*

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THE DIALECTICAL CONSTITUTION OF ARITHMETIC PRACTICE

Introduction

The ubiquity and unremarkable character of routine activities such as grocery shopping qualify them as apt targets for the study of thought in its customary haunts. For the same reasons, such activities are difficult to analyze. We think such an enterprise depends on an *integrated* approach to everyday activities in their usual contexts. In this chapter we address the general problem at a fairly specific level, analyzing a recently gathered body of data. This example involves a ial institution, the supermarket, an environment highly

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The Adult Math Skills project has as its goal the exploration of arithmetic practices in daily life. Michael Murtaugh has carried out one branch of the project, developing both theory and method for analyzing decision-making processes during grocery shopping, including the role of arithmetic in these processes. This has involved extensive interviewing, observation and experimental work with twenty-five adult, expert grocery shoppers in Orange County, California. Detailed transcribed observations of shopping preparation, a major shopping trip, storage and use of the purchased foodstuffs over a period of weeks, compose one dimension of the work. A comparative dimension, involving a sampling of arithmetic practices in several settings by these same individuals, will be discussed below. The Orange County residents vary in age from 21 to 80, in income from $8,000 per family to $100,000, and in education from 8th grade to an M.A. degree. Twenty-two are female, all are native speakers of English, whose schooling took place in U.S. public schools.

In recent years there has been increasing concern about the ecological validity of experimental research within cognitive and developmental psychology (e.g. Bronfenbrenner and Mahoney, 1975; Neisser, 1976; Cole, Hood and McDermott, 1978; Bronfenbrenner, 1979). These, and other, researchers have speculated that the circumstances that govern the role of most problem solving activities, in situations which are not prefabricated and minimally negotiable, are different from those which can be examined in experimental situations. The questions raised by these speculations are fundamental and demand more radical changes in the nature and scope of theory and empirical research than has, perhaps, been generally recognized (see the Introduction, this volume). Because we are trying to develop a new perspective from which to consider cognition in context we initiate the enterprise here as simply as possible, with a series of commonsense propositions about the contextualized nature of human activity. These will provide guidelines for the empirical study which in turn may suggest more strongly the outlines of a systematic theoretical position.

1) Let us assume that "arithmetic activity" has formal properties which make it identifiable in the flow of experience in many different situations. 2) Arithmetic problem solving is smaller in scope than the units of activity in which people organize and think about their activities as wholes, and in relationship to which settings are

specifically organized. The enormous productivity of script theory, on the one hand, and the organization of environments in relation to 'scripted' activities, e.g., "the drugstore," "fourth grade classroom," suggest that human organization of activity gives primacy to segments on the order of 10 minutes to 2 hours. 3) If this is so, solving an arithmetic problem must be experienced by actors as a small segment of the flow of activity. 4) It follows from (2) and (3) that the character, form, outcome and meaning of arithmetic activity should be strongly shaped by the broader scope of activity and setting within which it occurs. 5) It will also be shaped by the past experience and beliefs of the problem solver about what the individual believes herself to be doing, what should happen in the course of it, and the individual's personal version of the setting in which she acts. 6) And finally, an "integrated" approach to activity in context has two meanings: the integral nature of activity in relation with its contexts; and the mutual entailment of mental and physical activity. Both meanings of "integration" imply a prescription for research methodology: that relevant data is to be acquired as directly as possible about people-doing-in-context.

These propositions do not constitute a theory of activity in setting, for they do not specify relations between activity and setting, or between the individual and the social order within which the world is actively experienced. In their present form, however, they suggest a series of analytic steps, and it is around these that the remainder of the chapter is organized. Grocery shopping is an activity which occurs in a setting specialized to support it--the supermarket. "Grocery shopping" is what we asked our informants to do, during which we paid special attention to arithmetic segments of activity in context, and within the flow of activity. The analysis begins at that level, then, with the supermarket as arena for grocery shopping activity.[1] The analysis of setting and activity is focussed on the question, what is it about grocery shopping in supermarkets that might create the effective context for what is construed by shoppers as "problem solving activity." What, then, are the general characteristics of problem solving, when something happens in the course of shopping that appears problematic to the shopper? And finally, how does the character of problem solving activity within grocery shopping specifically affect the nature of arithmetic problem solving? To answer these questions, we begin by taking apart the unit of analysis, that is, activity-in-setting.

Setting

Our current view, that the relation between activity and setting is a dialectical one, conflicts with Barker's position which assumes a unidirectional, setting-driven, relation between activity and setting. Nonetheless our conceptualization of setting derived initially from the work of Barker and his colleagues (e.g. 1963, 1968). He states his position thus (p. 4),

> The view is not uncommon among psychologists that the environment of behavior is a relatively unstructured,

> passive, probabilistic arena of objects and events upon which man behaves in accordance with the programming he carries about within himself . . . . But research at the Midwest Field Station and elsewhere indicates that when we look at the environment of behavior as a phenomenon worthy of investigation for itself, and not as an instrument for unraveling the behavior-relevant programming within persons, the situation is quite different. From this viewpoint the environment is seen to consist of highly structured, improbable arrangements of objects and events which coerce behavior in accordance with their own dynamic patterning.

For Barker (1968), a segment of the environment is sufficiently internally coherent and independent of external activity flow to be identified as a behavior setting, if little of the behavior found in the setting extends into another setting; if there is sufficient but not too much sharing of inhabitants and leaders of the activity in that setting; if behaviors in the setting are closer to each other in time and space than to behaviors outside the setting; and if there is sharing of behavior objects and modes of behavior in subparts of the behavior setting but little such sharing between this setting and adjacent ones. Barker and his colleagues operationalize these criteria in complex ways, and undertake the monumental feat of describing all of the behavior settings of a year's behavior in a small town in Kansas (Barker and Wright, 1954). The goal of this effort is not to produce an ecological description of a town, but to establish a basis that accounts for the behavior of its inhabitants. They argue that for each setting there is a standing pattern of behavior (it can be thought of as a set of norms prescribing appropriate behavior; they often refer to "rules of the game" literally, in describing favorite behavior settings, such as baseball games). Further, the setting and the patterned sequence of behavior taking place in the setting, are similar in structure, or "synomorphic."

Barker's conceptualization of setting as a peopled, furnished, space-time locus, is an interestingly complex one, particularly in his insistence that varied relations among the multiple elements (people, behavior, furnishings, space and time) of setting contribute in different degrees to the establishment of boundaries for different settings. Although he maintains that settings are objective entities, independent of observer and participant alike, it is a short step, for the theoretically insouciant, to the view that changing relations of space, time, people, furnishings, etc., that create settings for activity are the constructions of participants. (Indeed, this is not far from the position taken by Cole and the Laboratory of Comparative Human Cognition, 1981). But care is required here, for if setting is not an objective phenomenon, how do we account for Barker's extremely elaborate and often convincing enumeration of behavior settings, in practice? We will return to this question in a moment.

On the other hand, there are difficulties with Barker's objectivist approach. Especially, his emphasis on the setting-driven nature of behavior makes the parallel analysis of the internal organization of activity uninteresting, indeed, impossible--it remains a passive response to the setting. It also precludes analysis of the relation between behavior and setting, beyond the simple principles just mentioned, because only one of the two poles of this relation is available for analysis in its own right. Nor does its unidirectional nature keep Barker from recognizing the existence of a more complicated state of affairs than his model will encompass. Thus, he says in passing,

> a great amount of behavior in Midwest is concerned with creating new milieu arrangements to support new standing patterns of behavior, or altering old milieu features to conform to changes in old patterns of behavior. (1968, p.).

But their model has no mechanism in it that would account for these possibilities.

The simultaneous existence of a theory with which we disagree, and impressive empirical data in its support that calls effectively into question the constructivist alternative, poses a dilemma. We propose a time honored solution: that both views are partially correct, though neither complete. Thus, certain aspects of behavior settings have durable and public properties, as Barker's data suggest. The supermarket, a behavior setting in Barker's terms, is such a durable entity; a physically, economically, politically and socially organized space-in-time. In this aspect it may be called an arena within which activity takes place. The supermarket as arena is the product of patterns of capital formation and political economy. It is not negotiable directly by the individual. It is outside of, yet encompasses, the individual, providing a higher-order institutional framework within which setting is constituted. At the same time, the supermarket is a repeatedly experienced, and hence codified, personally and interpersonally ordered and edited version of the arena, for individual shoppers. In this aspect it may be termed a setting for activity. Some aisles in the supermarket do not exist for a given shopper as part of his setting, while other aisles are multifeatured areas to the shopper, who routinely seeks a particular familiar product.

The relationship between arena and setting is reflected in the ordinary use of the term "context." What appear to be contradictory features of meaning may be accounted for by recognizing that the term applies to a relationship rather than to a single entity. For on the one hand, 'context' connotes an identifiable, durable framework for activity, with properties which clearly transcend the experience of individuals, exist prior to them, and are entirely beyond their control. On the other hand, it is clearly experienced differently by different individuals. In the course of the analysis we shall try to distinguish between the imposed constraints of the supermarket as arena, and the constructable, malleable nature of the setting in relation with the activity of particular shoppers. Because a social order and the experience of it mutually entail one another, there are, of course, limits on both the obdurate and malleable aspects of every context.

Activity

In developing a set of assumptions about activity, we begin with the active individual in action and interaction with her context. But there is more to it than the mode of relation by which the individual is engaged with the context of activity. Here we have drawn on the concept of activity as it has been developed in Soviet psychology, particularly in the work of Leontiev. Activity theory, in contrast with Barker's setting-dominated view of the interaction, is able to address the order intrinsic to activity. Activity, "is not a reaction or aggregate of reactions, but a system with its own structure, its own internal transformations and its own development." (Wertsch, 1981, p. 42; quoting Leontiev). It may be characterized, in Leontiev's terms, at three levels of analysis.[2] The highest level is that of activity, e.g. play, work, formal instruction, which occurs, according to activity theory, in relation to motive, or energizing force. As Wertsch explains, "Leontiev often uses hunger as an example of a motive. This provides the energizing force behind an organism's activity, but at this level of abstraction nothing is said about the goals or ends toward which the organism is directed." (Wertsch, 1979, p. 12). This level appears abstract enough that it is difficult to tell if it would meet the criteria proposed here, in which the highest order unit of analysis is person-doing-in-context. The distinction would become a point of disagreement to the extent that "work" or "play" refer to cultural categories of activity rather than specific activities in context. The remaining levels in the theory of activity fit more easily with the units of analysis proposed here. Thus, the second level is that at which an action is defined by its goal, e.g. solving an arithmetic problem or finding the shelf in the supermarket with olives on it. "An action is a segment of human functioning directed toward a conscious goal." (Wertsch, 1979, p. 12). The third level is that of operations, which contrasts with that of action by not involving conscious goals. Instead, "certain conditions in the environment influence the way an action is carried out without giving rise to consciously recognized goals or subgoals." (Wertsch, 1979, p. 15). Examples would include shifting gears in the car (for an expert driver), or putting a can of olives in the grocery cart.

It is not our intention here to map a multi-level system of our own onto Leontiev's, and draw lessons from the similarities and differences; difficulties of translation and comparison suggest that the moral should be a more general one: principally, a strong commitment to the wholistic nature of activity in context. This may be made clearer by providing one example of interlevel relations. Leontiev places strong emphasis on the derivation of meaning, by actors, from the multilevel activity context. He locates it in relations between the levels of activity and action, on the one hand, and action and operation, on the other. The distinction he makes, between "sense" and "meaning," parallels those we have suggested in distinguishing the concept of arena from that of setting. For Leontiev, "sense" designates personal intent, as opposed to "meaning" which is public, explicit, and literal. "Sense" derives from the relations of actions and goals to motivated (higher order) activities of which they are a particular realization. Furthermore, "the goal of one and the same action can be consciously realized in different ways, depending on the connections it has with the motive of the activity." (Wertsch, 1981, p. 52). This same relational emphasis operates "downward" in the system of activity as well, at the action/operation interface. Zinchenko's work (cited by Wertsch, 1981) provides an apt example. In his research, tasks were designed so that the "same" arithmetic problems were to be treated as conscious actions in one experimental session, and as operations in the course of inventing math problems, in another. The arithmetic stayed the same, in formal mathematical terms, while its role in the subject's activity changed. This change had clear affects on the subjects' memory of the arithmetic, according to Zinchenko:

> Material that is the immediate goal of an action is remembered concretely, accurately, more effectively, more durably. When related to the means of an action (to operations) the same material is remembered in a generalized way, schematically, less effectively, and less durably. (Wertsch, 1981, p. 60).

These results support our conviction that to comprehend the nature of arithmetic activity as a whole, requires a contextualized understanding of its role within that activity. Indeed, the work of Zinchenko and Leontiev and their colleagues provides a strong argument for the necessity of analyzing any segment of activity in relation to the flow of activity of which it is a part.

One could construe the argument so far as follows: take Barker's theory of behavior settings and tinker with it, then adapt Leontiev's theory of activity, and finally, combine them. If this summed up our intentions, the major difference between our analysis and theirs would be only its scope. But neither Soviet psychology nor Barker's functionalist brand of setting-determinism (see the Introduction, this volume) make it possible to address the nature of the articulation between activity and setting. A few words on this subject must precede the ethnographic analysis towards which we are moving.

We have distinguished between a supermarket as an arena, a non-negotiable, concrete realization of a political economy in place, and the setting of grocery shopping activity, which we take to be the individual, routine version of that arena which is both generated out of grocery shopping activity and at the same time generates that activity. In short, activity is conceived of as dialectically constituted in relation with the setting. For example, suppose a shopper pauses for the first time in front of the generic products section of the market, noting both the peculiarly plain appearance of the products, divested of brand and other information to which the shopper is accustomed, and the relatively low prices of these products. This information may be added to an existing repertoire of money-saving strategies. In fact it provides a potential new category of money-saving strategies, if the shopper incorporates the new category. This in turn leads the shopper to attend to the generic products on subsequent shopping trips. The setting for these future trips, within the supermarket as arena, is thereby transformed. And the activity of grocery shopping is transformed by change in the setting within the arena. A fuller account of activity-setting relations in dialectical terms may be found elsewhere (e.g. the Introduction, this volume). The point to be made here is that neither setting nor activity exist in realized form, except in relation with each other; this principle is general, applying to all levels of activity-setting relations. The nature of dialectical relations will become clearer in the course of more extensive ethnograhpic analysis.

The Supermarket and Grocery Shopping: Arena, Setting and Activity

The arena of grocery shopping is the supermarket, an institution at the interface between consumers and suppliers of grocery commodities. Many of these commodities are characterized in consumer ideology as basic necessities, and the supermarket as the only avenue routinely open for acquiring them. Typical supermarkets keep a constant stock of about seven thousand items. The arena is arranged so that grocery items remain stationary, assigned locations by suppliers and store management, while shoppers move through the store, pushing a cart, searching for the fifty or so items he or she buys on a weekly basis. The arena may be conceived of as an icon of the ultimate grocery list: it is filled with partially ordered sequences of independently obtainable objects, laid out so that a physical progression through the entire store would bring the shopper past all seven thousand items.

A shopper's progress through the arena, however, never takes this form. The supermarket as "list" and the shopper's list are of such different orders of magnitude that the fashioning of a particular route through the market is inevitable. Part of what makes personal navigation of the arena feasible is the ordered arrangement of items in the market, and the structured nature of purchase-intentions of the shopper. The *setting* of grocery shopping activity is one way of conceptualizing relations between these two kinds of structure. It may be thought of as the locus of articulation between the structured arena and the structured activity; it is the relation between them, the "synomorphy" of Barker's theory.

For example, the arrangement of the arena shapes the setting, in that the order in which items are put in the cart reflects their location in the supermarket rather than their location in any of the activities from which shoppers routinely generate their lists. On the other hand, the setting is also shaped by the activity of the shopper: without babies and dogs, he may routinely bypass the aisles where diapers and dogfood are located; expectations that the chore ought not take more than an hour shape the amount of time the shopper allocates to each item, and hence the degree of effort and structure to her search. This in turn has articulatory implications for the arena: it is created in response to the character of individual search structures, for example, in packaging design and display of products.

The character of the resulting synomorphy is part of what is meant by "setting." It is particularly important to stress the articulatory nature of setting, not because setting is unique in this respect, but because it would be easy to misunderstand the concept as simply a mental map, in the mind of the shopper. Instead, it has simultaneously an independent, physical character, and embodies a potential for realization only in relation to shoppers' activity. All of this together constitutes its quintessential character. The mutual relations between setting and activity, such that each creates the other, both coming into being at the same time, is not so difficult to observe, though difficult to convey in the medium of print. But a transcribed incident may help to illustrate the phenomenon.[3]

A shopper and the anthropologist walk toward the frozen enchilada case. Until the shopper arrives in front of the enchilada display it is as if she were not just at a physical, but a cognitive distance from the enchiladas. In contrast, she and the enchiladas, in each other's presence, bring into being an entirely different quality to the activity.

Shopper: . . . Now these enchiladas, they're around 55 cents. They were the last time I bought them, but now every time I come . . . a higher price.

Observer: Is there a particular kind of enchilada you like?

Shopper: [speaking hesitantly, eyes searching the shelves to find the enchiladas]: Well they come in a, I don't know, I don't remember who puts them out. they move things around too. I don't know.

Observer: What is the kind you're looking for?

Shopper: Well, I don't know what brand it is. they're just enchiladas. They're put out by, I don't know.

She discovers the display of frozen Mexican dinners, at this moment.

Here they are! [spoken vigorously and firmly]: They were 65 the last time I bought them. Now they're 69. Isn't that awful?

This difference--between activity in setting, on the one hand, and activity and setting caught in transit, not in any particular synchrony (or synmorphy), on the other hand--is ubiquitous in our data. It confirms the integral and specific character of particular activities in particular settings.

Grocery shopping activity is made up of relatively discrete segments, such as this enchilada purchase. The shopper stops in front of one display after another and goes through a process of deciding which item to transfer from shelf to cart. In most cases it is possible to face the display and locate and take it from the shelf without moving more than a foot or two out of the original place. Within an item display area, size and brand are taken into account, in that order, in making decisions, while price and quantity are considered at the end of decision processes.[4] But the complexity of the search process varies a great deal across items. Many selections are made without apparent consideration, as part of the routine of replenishing supplies. More often than not, however, shoppers will produce an account for why they routinely purchase a particular item rather than an available alternative. We call this using "old results." It suggests that part of the move from novice to expert grocery shopper involves complex decision processes, a few at a time, across many trips through the market.

Much of the decision making which takes place as shoppers place themselves in physical relation with one display after another, is of a qualitative nature--particular foodstuffs for particular meals, brands which have particular characteristics, e.g., spicy or mild, and so on. Shoppers care about the taste, nutritional value, dietary implications and aesthetics of particular groceries. In relation to this qualitative decision making, commodity suppliers and store management respond with large amounts of persuasive information about products, much of it adhering to the item itself. Shoppers face overwhelming amounts of information, only a small part of which they treat as relevant. Even this information is brought into play only when a shopper establishes a new choice or updates an old result. In general, through time, the experienced shopper transforms an information-rich arena into an information-specific setting. It appears that cognitive transformations of past experience, and presence in the appropriate setting, form an integrated whole which becomes the basis of what appear to be habitual, mechanical-looking procedures for collecting items purchased regularly.

The integration of activity-in-setting is not limited to repeated purchases. Nor is setting merely a stage within which action occurs. Both of these points may be illustrated by calling attention to the fact that the setting imposes shape on potential solution procedures, in cases of new search or problem solving. Indeed, the setting often serves as a calculating device. One shopper, for example, found an unusually high priced package of cheese in a bin. He suspected that there had been an error. To solve the problem he searched through the bin for a package weighing the same amount, and inferred from the discrepancy between prices, that one was in error. His initial comparison to other packages had already established which was the errant package. Had he not transferred the calculation to the environment, he would have had to divide weight into price, mentally, and compare the result with the price per pound printed on the label, a much more effortful and less reliable procedure. Calculation of weight/price relations devolved on the structured relations between packages of cheese (their weight varied, but within a rather small range; weight, price per pound, and price were printed on each package but not the steps in the calculation of price per pound) and the activity of the shopper (who searched among them for an instructive comparison). In another case a shopper exploited the fact that chicken thighs come in packages of six. She compared package prices and chose a cheap one to insure small size, a moderate priced package when she wanted larger serving portions. In this case, also, weight/price relations were enacted in the setting.

Shoppers describe themselves as engaged in a routine chore, making habitual purchases. But the description must be addressed as data, not analysis. Rather than treating "habit" and "routine" as empirical descriptions of repeated episodes of the same activity in the same setting, we prefer to treat them as statements of an ideological order. For the arena and the general intentions of the shopper--"doing weekly chores," or "grocery shopping, again"--come into juxtaposition repeatedly in such a way as to make it both customary and useful for the shopper to claim that it is "the same" from one occasion to the next.

The similarity is not a matter of mechanical reproduction, however. The truth of this is first and foremost one of definition--it is part of the set of assumptions with which we began. But there is more to be said, for it is a complex problem at several levels. For one thing, shoppers shop in routinely generative ways, for grocery lists almost always include categories such as "treats" for children. Second, the setting generates activity as well: consider the experience of walking past a display and having a delayed reaction which leads to a backtrack and consideration of a needed but forgotten item. And third, relations between activity and setting are so highly structured in so many ways that salient aspects of the process such as the sequence of choices (alternatively, the path through the arena) are not all that heavily constrained: what one learns from past experience is not a fixed path through the setting but the numerous short run structuring devices which can be played end to end, to produce one path this time, a different but structurally related path another.

For instance, shoppers do not generally order their physical activity to conform to the order of their private grocery lists. This would involve much greater physical effort than ordering activity to conform to the market layout. This is explicitly confirmed by shoppers:

> Well, let's see if I've got anything over in this . . . I usually [look] and see if I've got anything in these, yeah,

> I need some potatoes . . . I usually shop . . . in the department that I happen to be in. I check my list to see if I have anything on the list, to save me from running all over the store.[5]

Saving physical effort is a useful rationale for using setting to organize the sequence of shopping activity. But there is a more general--and generative--principle at work. Personal grocery lists contain items whose interrelations are often not relevant to the organization of the arena. When ordered in anticipation of their location in the market, they tend to appear as discrete items. Within grocery shopping, as we have already remarked, segments of activity are relatively independent and hence one segment rarely is a sequentially ordered condition for another one. Almost by default, it is the structure in the setting that shoppers utilize to order their activity. It gives the appearance of a choice between mental and physical effort, when it is in fact a choice between a more, and a less, compellingly structured component of the whole activity-in-setting, any structure being available for use in sequencing the activity. If, or rather, when, the structure of shoppers' lists involves item- interdependence (e.g. buy eggs only if the ham looks good), then the source of sequencing might just as well be the list instead of the market layout, or some mix of the two.

In sum, we have tried to suggest the complex, generative nature of an activity-in-setting labelled by its practitioners as a routine chore; and on the other hand to suggest that descriptions such as "habitual" and "routine" are ideological in nature, and lead shoppers to interpret their own activity as repetitive and highly similar across episodes, rather than to treat as normative its non-mechanical, generative variability (as we normatively characterize "education" and "research"). This set of considerations must surely affect the manner in which shoppers come to see certain parts of activity-in-setting as smooth repetitions and others as problematic.

Problem Solving in Grocery Shopping Activity

Problem solving in grocery shopping takes its character from the routine nature of the activity-in-setting, from the overdetermined nature of choice and from the dialectical relations between activity and setting. We shall consider each in turn.

Grocery shopping shares with some, but not all, other activities-in-setting its routine character. Frequent, regular visits to a public arena with the intention of carrying out a repeated activity, leads to actors' interpretation of activity in that setting as "routine." Furthermore, the ideology makes repetitive activity and repeated use of the same arena look sensible. This gives character to the particular dialectical relation between chores such as grocery shopping and settings such as those in supermarkets. This relation is one in which repeated interactions have produced smooth "fit" between activity and setting, a streamlining of each in relation to the other. (Turning an information-rich arena into an information-specific setting is an example of what is intended here.)

The routine character of chores such as grocery shopping is generated in a larger context, which contributes to its stability. For grocery shopping is part of a set of interrelated activities involved in the management of food for the domestic context. There is a relatively constant relationship between the scope of the activity "weekly grocery shopping," and that of activities in other settings such as meal planning and cooking, including a consistent division of food processing effort among them. The sameness of grocery shopping over repeated episodes helps to maintain the routineness of these related activities as well. Thus, there is a connection between habitual grocery purchases and regularly prepared, "standard" family meals. In each example here the shopper is looking for an ingredient for such a standard meal.

Observer: So now you're looking at the cheese?

Shopper: Yes. I make that goulash stuff I was telling you about. And I use mozzarella.

Another shopper remarks:

> Oh, and I'll have to get corn bread now, because I forgot to put that on my list. We like corn bread with chicken.

And another:

> We're out of hot sauce, so I have to buy hot sauce for the burritos.

An ideology of routineness embodies expectations about how activity will proceed; that a "routine" episode will unfold unproblematically, effortlessly--rather as if the whole enterprise ideally had the status of an operation, in activity-theory terms. It is in relation to this expectation that a snag or an interruption is a problem. It follows that where both expectations and practice lead to relatively unproblematic activity, snags and interruptions will be recognized, or invented or viewed, as properly limited in scope--as small scale relative to the activity as a whole. And like grocery shopping activity-in-setting, the segments of which it is composed, including problem solving segments, are generated, rather than mechanically reproduced, over a series of occasions.

A second determinant of the character of problem solving in grocery shopping is the nature of the choices to be made by the shopper. The supermarket is thought of by consumers as a locus of abundant choices, for which the stock of thousands of items constitutes apparent evidence. But in contradiction to this view, there stands a different order of circumstance: the shopper cannot provide food for the family if he leaves the supermarket, trip after trip, empty-handed, due to repeated attacks of indecision. That is, the shopper, faced with abundant alternatives, nonetheless cannot avoid making choices. Conversely, because the making of choices cannot be avoided, it is possible for decision criteria to proliferate in the shopping setting; any small set is sufficient as a basis for choosing one item rather than another. This contributes to the shopper's experience of abundant choices, and helps to maintain the contradiction.

The contradictory quality of routine grocery choice is a crucial point in understanding what has been described as the rationalizing character of everyday thought, of which arithmetic calculation in the supermarket provides a typical case. The term "rationalization" is used in common parlance to refer to after-the-fact justification of an action or opinion. It has been proposed as a hallmark of everyday decision-making (e.g., Bartlett, 1958). The term contrasts sharply with folk characterizations of rational decision making, in which evidence should provide logical motivation for a conclusion. Without the contradiction, we shall argue, the production of a rational account of choices would not be construed by the observer as "rationalization." Activity-in-setting is complex enough that a description of the activty as "marshalling the evidence after the fact" does not take into account contradictory, multiple relations between evidence and conclusions. For in decision processes such as those in grocery shopping, it is impossible to specify whether a rational account of choice is constructed before or after the fact. It occurs both before and after different orders of fact; before a unique item is chosen but after the determination that a choice must be made. The "rationalizing" relation of evidence to conclusion is not, then, a matter of "everyday thinking" or "unscientific use of evidence," but an unavoidable characteristic of the activity of grocery shopping. The relations between evidence and conclusion are an inevitable outcome of the organization of the activity-in-setting, rather than the mode of operation of the everyday mind.

Arithmetic problem solving plays various roles in grocery shopping, not all of which will be discussed in this chapter. We will concentrate on price-comparison arithmetic, because it constitutes the preponderance of cases in our data, and because this kind of calculation serves in the "rationalizing" capacity just described. It occurs at the end of decision making processes which smoothly reduce numerous possibilities on the shelf to single items in the cart, mainly on the basis of their qualitative characteristics. A snag occurs when elimination of alternatives comes to a halt before a choice has been made. Arithmetic problem solving is both an expression of, and a medium for dealing with, stalled decision processes. It is, among other things, a move outside the qualitative characteristics of a product, to its characterization in terms of a standard of value, money.

That arithmetic is a prevalent medium of problem solving among shoppers, and elsewhere, is itself an interesting problem. Certainly it justifies choice in terms that are symbolically powerful in this society, being both mathematical, i.e. "objective," and monetary. In the supermarket, calculation may be the most immediate means of rational account construction in response to interruption because of its condensed symbolic connections to both mathematics and money, that is, its position in folk theory about the meaning of rationality. Indeed, a good case can be made that shoppers' ideological commitment to rational decision making is evidenced by their justificatory calculations and explanations, for the alternative is to declare selection, at that point, a nonchoice. Only rarely in the transcripts do shoppers recognize the unavoidable, and hence in some sense arbitrary, nature of choice. One shopper, referring to a TV commercial in which an animated package of margarine gets in an argument at the dinner table, selects this brand and comments ironically:

> Shopper: I'll get the one that talks back.
>
> Observer: Why?
>
> Shopper: Others would have been more trouble.

Support for our interpretation of price arithmetic as rational accounting (in both sense of that term) comes from Murtaugh's (1983) research on the decision processes used by shoppers in choosing grocery items. He shows that if arithmetic is utilized, it is employed near the end of the process, when the number of choices still under consideration is not greater than three and rarely greater than two. Thirteen shoppers purchased 450 grocery items. Of these items, 185 involved problem solving of some variety and 79 of these latter items utilized arithmetic. There were 162 episodes of calculating, approximately two calculations per item on which calculation occurred. Of these calculations, 122 (73%) involved price-comparison arithmetic; 104 compared prices for equal quantities of some grocery item and the remaining 18 both price and quantity comparisons. It would be difficult to picture arithmetic procedures, in the light of these data, as major motivations 'driving' shopping activity. Justifying choices, just before and after the fact, is a more appropriate description of its common role. Demographic data provide indirect support for the argument that most grocery arithmetic serves as a medium for building a rational account for overdetermined choices. The incomes of the shoppers varied enormously, but this variation does not account for differences in calculating frequency by the shoppers (Spearman r = -.0879, n.s.). Decisions that affect a family food budget tend to be made elsewhere than in the supermarket. These decisions include which supermarket to frequent, and how much to spend on particular meals, how often.

So far, we have argued that a "problem" in routine activity-in-setting is an interruption or snag in that routine, and that arithmetic is often used in a rational accounting capacity to overcome snags. A third critical feature of problem solving follows from the charcter of activity-setting relations as a whole. We have taken the dialetical relation between activity and setting as an assumption; (arithmetic) problem solving is part of activity-in-setting and thus must conform to the same dialectical principle, by which it is brought into being, reproduced, and transformed. If activity-in-setting as a whole is crucial in shaping problem solving segments of activity-in-setting, the character of problem solving activity should vary from setting to setting. Barker and his colleagues supply much supporting data for consistent variation in behavior across settings (e.g. 1954, 1963). Our own comparative data support the view that activity varies strongly in relation with setting.

Thus, we contrived a second activity-in-setting in which the shoppers took an extensive paper-and-pencil arithmetic test, covering integer, decimal, and fraction arithmetic, using addition, subtraction, multiplication and division operations (based on a test from the Torque

Project, MIT). The sample of shoppers was constructed so as to vary in amount of schooling and in time since schooling was completed. Problem-solving success averaged 59% on the arithmetic test, compared with a startling 98%--virtually error free--arithmetic in the supermarket.[6] Subtest scores on the arithmetic test are highly correlated with each other, but not with frequency of arithmetic problem solving in the supermarket. (We turned to this dependent variable after finding no variance in the problem solving success variable.) Number of years of schooling is highly correlated with performance on the arithmetic test but not with frequency of calculation in the supermarket [add more correlation coefficients?] Years since schooling was completed, likewise, is significantly correlated with arithmetic test performance (Spearman $r = -.58$, $p < .001$) but not with grocery shopping arithmetic (Spearman $r = .12$, n.s.). In short, to the extent that correlational evidence provides clues, it appears that arithmetic problem solving by given individuals in test and grocery shopping situations is quite different; at least it bears different relations with shoppers' demographic characteristics. An analysis of the specific procedures utilized in "doing arithmetic" in the supermarket lends substance to this conclusion. Moreover, such an analysis, to which we now turn, illustrates the dialectical form of arithmetic problem solving.

Dialectically Constituted Problem Solving Processes

A successful account of problem solving procedures in the supermarket will explain two puzzles uncovered in preliminary analysis of the grocery shopping data. The first is the virtually error-free arithmetic performance by shoppers who made frequent errors in parallel problems in the formal testing situation. The other is the frequent occurrence of more than one attempt to calculate in the course of buying a single item. Further, while the error-free character of ultimate problem-solutions is a remarkably clear finding, such is not the case for earlier calculations in a sequence, where more than one occurs. It would be useful to account for this as well.

First, it is useful to make explicit what is dialectical about the process of problem solving. The routine nature of grocery shopping activity and the location of price arithmetic at the end of decision making processes, suggest that the shopper must already assign rich content and shape to a problem solution at the time arithmetic becomes an obvious next step. Problem solving, under these circumstances, is an iterative process. On the one hand, it involves what the shopper knows and the setting holds that might help, and on the other hand, what the solution looks like. The latter deserves clarification: we take as axiomatic that the activity of finding something problematic subsumes a good deal of knowledge about what would constitute a solution. In the course of grocery shopping many of a problem-solution's parameters are marshalled into place as part of the process of deciding, up to a point, what to purchase. (Consider the shopper who knew which cheese package was inconsistent with others before he established whether there was really an inconsistency or not.) The dialectical process is one of gap closing[7] between strongly specified solution characteristics and information and procedural possibilities for solving the problem.

Thus a change in either solution shape or resources of information leads to a reconstitution of the other: the solution shape is generated out of the decision process up to an interruption or snag. But the act of identifying a "problem" changes the salience of setting characteristics. These in turn suggest, more powerfully than before, procedures for generating a specific solution; information and procedural knowledge accessed by eye, hand, and/or mental transformations thereof, make possible a move towards the solution, or suggest a change in the solution shape that will draw it closer to the information at hand.

The example that follows, drawn from a transcribed segment of a grocery shopping expedition, is fuller than those given previously. Let us make clear immediately what is general about it, and what are its limitations as a generalizable sequence of data. First, it successfully illustrates the dialectical nature of gap-closing arithmetic problem solving processes, and, more specifically, makes it possible to typify some of the parts of such processes. But the example is not generalizable with respect to all aspects of the argument developed in this chapter. In particular, a word of caution is appropriate about its relevance to the interpretation of price arithmetic as rational account-production activity. Interaction between the shopper and the observer in the transcribed example gives a special character to the activity segment,[8] perhaps not a difference of kind so much as one of degree (though our argument does not rest on this distinction). The shopper may well think of the observer as the embodiment and arbiter of normative shopping practices; and from his point of view, his role is to investigate empirically the appropriateness of normative models of rational problem solving (about which he is sceptical). We argue that the combined effect of the assumptions each has about the observer's role is to intensify the focus on rational accounting, in terms common to folk ideology and much of consumer economics; this, at the expense of the qualitative character of decision making which, in fact, leads to most purchase selections in the supermarket--even in our data (i.e. only seventy-nine items out of four hundred and fifty involved arithmetic).

At the same time, our argument about the account-production role of price arithmetic does not rest on the detailed description of such activity in this, or other, transcripts. Instead, we have argued that rational account-production derives from the location of arithmetic activity, almost always at the end of processes of decision making, under the conditions of constrained choice found in supermarkets. It is on this analysis, supported by numerical data on the location of arithmetic in decision processes, rather than on the transcript analysis, that the argument about rational accounting stands or falls. But, further, the following example in no way undermines that argument; rather, it provides (only) a specialized illustration of it.

In the shopping transcript, a forty-three year old woman with four children discusses the price of noodles. She takes a few steps towards the noodle display:

Shopper: Let me show you something, if I can find it. I mean talk about price [1].[9] Last week they had that on sale I think for 59 cents.

Observer: Spaghetti?

Shopper: [with the vagueness associated with imminent arrival-- see the enchilada example, p. 15] Yeah, or 40--I can't remember . . . That's not the one.

She then puts an old result into practice, taking a package of elbow noodles from the shelf and putting it in her cart. It is a 32 ounce package of Perfection brand noodles, costing $1.12. This decision prefigures and shapes the course of the conversation, and calculations, which follow. The latter are best buy problems, comparing price per unit of weight for pairs of packages. The other three packages weigh 24 ounces, 48 ounces and 64 ounces. The difference in price per unit is not a linear function of size. That is, in order by weight:

American Beauty noodles,	24 oz. for $1.02	68¢/lb
Perfection noodles,	32 oz. for $1.12	56¢/lb
American Beauty noodles,	48 oz. for $1.79	59 1/2¢/lb
American Beauty noodles,	64 oz. for $1.98	49 1/4¢/lb

The 64 ounce package is, of course, the best buy.

Observer: [acknowledging her choice] [1] Perfection. [The brand name.]

Shopper: Yeah. This is what I usually buy. Its less expensive than--is that American Beauty [2]?

Observer: Yeah.

Shopper: That, what I need right now is the elbow macaroni [noodles]. And I always buy it in two pound [3] . . . [packages]. I'm out of this.

The first underlined segment is the choice which establishes the point of reference for comparative calculations. The second, establishes an initial solution shape, and the third provides evidence both that the choice is an old result and that numerical simplification work has occurred, since the weight on the package is expressed as "32 ounces" rather than as "2 pounds." She expands on the qualitative choice criteria which have shaped her purchase in the past:

Observer: This seems like a big package of elbow noodles and you add these to the macaroni?

Shopper: I add some, I just take a handful and add it to the rest, to the other packaged macaroni 'cause I add macaroni to it. Plus I use that for my goulash [1].

Observer: For the goulash. O.K. And you . . . like these particular kind? Are there other alternatives here?

Shopper: Yeah. There's large elbow. This is really the too-large economy bag [1]. I don't know if I, probably take me about six months to use this one. And I just, I don't have the storage room for that kind of stuff [1]. I guess if I rearranged my cupboards maybe I could, but it's a hassle [1] . . . . I don't know, I just never bought that huge size like that [1]. I never checked the price though on it. But being American Beauty it probably costs more even in that large size [2].

Her comments reinforce the expected direction of American Beauty/Perfection noodle price comparisons [2]. (While this judgment is correct for 24 and 48 ounce packages, it is incorrect for the 64 ounce size. But the matter does not rest here.)

More important, the nature of the decision-making problem is here shown in integral relation with the particulars of interaction between the shopper and the observer. For qualitative reasons (use in standard meals, storage capacity, etc. (1)) she has previously avoided purchase of the large size. But she is caught in a public situation in a discussion for which we shall see evidence that she would like to display her shrewdness as a shopper. And best buy purchases are the best evidence of rational frugality in this setting (even though qualitative criteria take precedence for her, as for most shoppers, most of the time).

The next interchange starts a process of simplification of the arithmetic comparison. She transforms large numbers of ounces into a small number of pounds.

Observer: That's what, that's 6 . . . [64 ounces?]

Shopper: It's 4 pounds and what did I buy, 2? Oh, there is a big savings [1]. Hmmm. I might think about that next time [1], figure out where I can keep it. I actually try to look for better prices [2]. I used, I guess I used to and I was such in the habit of it that some of the products I'm buying now are leftovers from when I was cutting costs [3]. And I usually look. If they have something on sale, you know, a larger package of macaroni or spaghetti or something, I'll buy it.

If the preemptive character of financial evidence as a means of demonstrating utilitarian rationality requires illustration, this segment provides it. The shopper's clearly stated earlier decision to reject the large size package on the basis of kitchen storage capacity is not sufficient to override the opposite choice on monetary criteria, when challenged [1]. She places a general value on price as a criterion for choice [2] and correspondingly emphasizes that current financial state does not require such choices [3]. This has the effect of emphasizing the absolute nature of the value. It produces a half commitment to future action [1] which does not seem likely to occur once the pressure of observer demand on the production of rational "accounting" is removed. We think there is also a strategy of "if I can't be right, at least I can demonstrate my objectivity," both by admitting she is wrong and by accepting quantitative (symbolically objective) criteria as overridingly legitimate.

Meanwhile she has made a calculation, at the beginning of the segment, correctly, that four pounds of American Beauty noodles would be cheaper than two pounds of Perfection noodles. It is not possible to infer what calculation took place, only that she arrived at a correct solution.

The next example follows almost immediately in the transcript. She sees what appears to be a comparison of packages which offer a counter-example to the previous conclusion that the large size is a best buy. If correct, it would soften the impression that she had violated a general principle ("bigger is cheaper") in her shopping strategy.

Shopper: But this one, you don't save a thing [1]. Here's 3 pounds for a dollar 79, and there's 1 pound for 59.

She is comparing two packages of American Beauty spaghetti noodles. But what she believes to be a one pound bag weighs only twelve ounces. She very quickly notices the weight printed on the package and corrects herself in the following manner:

Shopper: No, I'm sorry, that's 12 ounces [2]. No, it's a savings.

This pair of statements ([1] and [2]) involve two calculations. In some form (there are alternative adequate representations among which we cannot distinguish) the first was probably 1 x 60 = 60 and 3 x 60 = 180, and therefore there is no difference between them in price per pound. If the weight of the smaller bag is less than one pound, then the equations are no longer equivalent, and the three pound bag is the better buy. Only a "less than" relation would be required to arrive at this conclusion.

The pattern of problem solving procedures used by J. is something like this: She starts with a probable solution, but inspection of evidence and comparison with the expected conclusion cause her to reject it. ("No, I'm sorry" is her acknowledgement that the initial problem solution is in error.) Pulled up short by the weight information from the package, she recalculates and obtains a new conclusion. This pattern is an example of gap-closing, dialectical movement between the expected shape of the solution and the information and calculation devices at hand, all in pursuit of a solution that will be germane to the activity which gave it shape in the first place.

The penultimate paragraph closed with a comment that "only" a less-than relation was required to complete the second round of calculation. However, the "only" is deceptive, as is the conciseness of her statements, if they convey the impression that the arithmetic is simple in the terms in which it would be represented in paper-and-pencil conventions: $1.79/3 \overset{?}{=} .59$. It requires an active process of simplification to transform it into the form suggested above.

Once J. has concluded that the large bag of noodles is a better buy than the small one, she comments:

> Shopper: They had some on sale there one day and the large package was like 69 for 2 pounds and it was 59 for 1 pound. And it was just such a difference, I, you know, it was almost an insult to the shopper to have the two on the same shelf side by side.

She concludes with another two-round calculation in gap-closing form. This episode is initiated by the observer who addresses the monetary but not the size difference, and emphasizes its magnitude. The observer may be trying to acknowledge her amended views, for he repeats her previous conclusion:

> Observer: Well, you seem to think this was a real big difference, then, this 4 pounds of --
>
> Shopper: Yeah, that is. That's 2 dollars for 4 pounds [1] [the American Beauty elbow noodles], this is a dollar [2] [referring to the Perfection elbow noddles in her cart], that's 50 cents a pound [3] and I just bought 2 pounds for

> a dollar twelve [4], which is sixty. So there is a difference.

She begins by simplifying $1.98 to two [1] dollars and $1.12 to one dollar [2]. But the calculation leads to the conclusion that both are 50 cents per pound. This conclusion, however, does not fit the established solution shape, "a big difference" between the smaller and larger bags of noodles. The current problem as simplified, produces an intermediate solution, that 4 pounds of noodles for two dollars is fifty cents per pound [3]. This move serves two purposes: as a means to recheck information simplified from that printed on the package; and as the first item in the next round of calculation. The second round is a similar price comparison, but with a "more than" relation: $1.12 is more than one dollar [4]. It would be consistent with a desire to appear objective and to meet the norms of the observer, that she would round up from 56¢/pound to 60¢. She thereby reiterates the earlier conclusion about the direction of difference in price.

One characteristic of the preceding account has been the need to assign multiple functions to individual moves in gap-closing arithmetic procedures. Dialectically ordered problem solving processes do pose problems when we try to describe them. Perhaps we must give up the goal of assigning arithmetic problems to unique locations--in the head or on the shelf--or labelling one element in a problem solving process as a "calculation procedure," another as a "checking procedure." It may be difficult, even, to distinguish the problem from its solution.

Another example may help to clarify these speculations. In her research on the acquisition of arithmetic skills by new members of Weight Watchers, de la Rocha (in preparation) posed a problem of food portion control: "Suppose your remaining allotment of cottage cheese for the week is three-quarters of the two-thirds cup the program allows?" The problem solver in this example began the task muttering that he'd had calculus in college, and then, after a long pause, suddenly announced he'd "got it!" From then on he appeared certain he was correct, even before carrying out the procedure. He filled a measuring cup two-thirds full of cottage cheese, dumped it out on a cutting board, patted it into a circle and marked a cross on it, scooped away one quadrant and ate the rest. Thus, "take three-quarters of two-thirds of a cup of cottage cheese" is not just the problem statement, but also the solution to the problem and the procedure for solving it. Since the environment was used as a calculating device, the solution is simply the problem-statement, enacted. At no time did the Weight Watcher check his procedure against a paper and pencil algorithm which would have produced 3/4 cup x 2/3 cup = 1/2 cup. Instead, the coincidence of problem, procedure, and enactment is the means by which checking takes place. One implication of this is that there is a strong monitoring potential in gap-closing procedures. It simply falls out of the nature of the activity when various aspects of problem solving are juxtaposed.

We have suggested that the calculations made by J. were possible because of her active construction of simplified versions of them. In order to do the complex work of simplifying problems, she needed a clear grasp of "what she was doing." "Knowing what one is doing" means having generated a process (e.g. decision making in the supermarket) oneself, in context. Faced with a snag, then, one has already produced a partial form of the solution.

Checking procedures, in this analysis of gap-closing arithmetic, consist of an ongoing process of comparing the current state of knowledge of the problem and the current definition of the solution. The intention is to check the plausibility of both procedure and solution in relation to previously recognized constraints on answer-characteristics rather than comparison of two linear problem solving procedures without reference to such constraints (the convention in pencil and paper arithmetic checking procedures).

In supermarket arithmetic, an alternative to arithmetic problem solving is abandonment of the arithmetic and resolution of snags through exercise of other options. A last example shows abandonment of a calculation when it becomes too complicated for solution, within grocery shopping activity in the supermarket setting. Abandonment, like a high level of success at calculation, supports our view that the juxtaposition of various aspects of problem solving makes monitoring of the process exceptionally productive. In the example, a forty-five year old mother of five children and her fifteen year-old daughter are shopping, together with the observer. The mother is interested in ketchup, but turns to the barbecue sauce, next to the ketchup, when her daughter calls attention to it.

Daughter: Do you want some Chris and Pits barbecue sauce? We're almost out.

Shopper: [to the observer]. Heinz has a special [on ketchup]. I have a coupon in here for that. And I was going to make spareribs one night this week, which I didn't mention to you, but that was in my mind now that she mentions the sauce. [shopper examines her coupons.] I want to see if their price on their barbecue sauce is going to be as--we usually buy Chris and Pits . . . Now see this is the one that I was telling you about. [She has noticed a Heinz ketchup coupon.] . . . But they don't have the 44 ounce ketchup here. [B. continues searching through the coupons until she finds the one for the barbecue sauce.] Okay, 25 cents off any size flavor of Kraft Barbecue Sauce including the new Sweet and Sour, which I would like to try because I'm going to have spareribs. But if you notice they don't have it. Oh, here they do. Hickory.

Observer: Kraft Hickory Smoked.

Shopper: Yeah, but they don't have the Sweet and Sour. [to her daughter] You see it, D? Nope. Okay, see now in a situation like this it's difficult to figure out which is the better buy. Because this is--I don't have my glasses on, how many ounces is that, D?

Daughter: 18.

Shopper: 18 ounces for 89 [refers to Kraft Hickory Smoked] and this is--

Daughter: 1 pound, 7 ounces--

Shopper: 23 ounces for a dollar 17. [referring to Chris and Pits.] [Then speaks ironically] That's when I whip out my calculator and see which is the better buy.

The comparison to be made has been simplified by putting both equations into the same units. But it requires a comparison which is difficult to simplify further: eighteen ounces for eighty-nine cents must be compared with twenty-three ounces for a dollar and seventeen cents. The comment about using a calculator could be interpreted, solely on the basis of its tone, as a move to abandon the calculation. But more convincing evidence is available. The shopper has a calculator in her purse, and has previously told the observer that she uses it rather frequently in the supermarket, yet on this occasion (as in all but one case) she makes no effort to get it out and suit action to words. She makes one more attempt to solve the problem, and then abandons it even more definitively.

Observer: So what are you going to do in this case?

Shopper: In this case what have we got here? I'll try to do it quickly in my head . . . They don't have the large um--

Daughter: Kraft Barbecue Sauce?

Shopper: Yeah, so what I'm going to do is, I'm going to wait, and go to another store, when I'm at one of the other stores, because I'd like to try this.

One choice open to shoppers is to abandon a calculation, in the course of which they choose an option to calculation as a basis for completing the decision process. Supermarket settings and grocery shopping activity are rich in options to calculate, and this circumstance adds support to what already appears to be a low penalty level for abandoning calculation in favor of some other criterion of choice. This contrasts with activity-in-setting in which problem generation, and hence constraints on problem solution, are furnished to the problem solver, in an asymmetrically structured sequence of interaction in which the problem solver has little to say about the terms. In these circumstances the only "option" other than success is failure, for example, on school tests and in many problem solving experiments.

In discussing problem solving in dialectical terms we have, among other things, been developing an explanation of the multiple-calculation (ultimately) error-free arithmetic practiced in the supermarket setting. Multiple calculations cannot be easily accounted for in the linear progression models assumed in conventional algorithm-based arithmetic procedures. But our theory of gap-closing, dialectically constituted, arithmetic procedures predicts that calculating will occur in multiple "rounds." We hope to have demonstrated this in practice as well. Multiple rounds are possible because of the initial conditions by which something becomes problematic in the course of activity-in-setting. The problem solver generates problem and solution shape at the same time; each entails the other. Procedures which operate on both problem and solution-shape stand in juxtaposition to one another. Errors, which are frequent in early rounds, can therefore be recognized and instruct. Why is the end product of supermarket calculation so accurate? First, dialectical processes of problem solving make possible powerful monitoring because of the juxtaposition of problem, solution and checking activity. When, in addition, properties of the setting join in as calculating devices, this adds another factor to those already juxtaposed: the enactment of problem solving. Second, any circumstance that makes abandonment of a calculation a feasible alternative, leads to fewer completed calculations, but more correct ones, than if options were not available. One main circumstance has been mentioned previously: if the process of problem generation is under the control of the problem solver, the solution shape is generated at the same time; alternatively, the problem solver may exercise options other than calculation.

In closing, we raise the question of how arithmetic practice might change over time within grocery shopping activity-in-setting, though we can do little more than indicate our interest in the problem. The effortful process of snag repair leads to a choice--to the moving of an item from shelf to shopping cart and the resumption of the rhythm of routine activity. The snag has been transformed into a rationally-accountable choice. The latter replaces both problem and solution effort in future grocery shopping episodes. But such a choice creates the terms for the occurrence of new snags, either as the choice becomes a baseline for new comparisons, or as the criteria invoked in a rational account are violated (e.g. by rising prices, changes in relations of price and quantity, changes in family composition or food preferences).

As a whole, grocery shopping activity changes over time, in a changing arena, in relation to changing activities-in-other-settings, and as a result of the activity taking place across repeated episodes. Shoppers marshal ideological efficiencies partially to domesticate this variability; but if they are to shape activity effectively, there must be scope within it for investigating, checking, updating and reflecting changes occurring in this setting and elsewhere. To be effective over time requires smooth routines partly because this enables shopper-setting interaction focussed about instructive novelties.

We have concentrated on snag repair but are now in a position to contrast this with a routine choice, when it becomes (for the moment) an activity-setting relation at its simplest. Think of the shopper's daughter in the last example as part of the setting. The daughter points out the barbecue sauce. The shopper does not go through a choice process, initially. Instead, she and the setting bring a choice into being. She reflects this in her comment: "that was in my mind, now that she mentions the sauce." The relevant aspect of the setting need not be a person: replace the daughter with a bottle of sauce on the shelf, and an equivalent event would be the shopper who does a double take as he passes this display, and backtracks slightly to transfer the "forgotten" item from shelf to cart. Each may be thought of as a moment in the dialectical constitution of activity and setting.

Conclusions

We have essayed here an analysis of the context of arithmetic problem solving in supermarkets, arguing that its defining characteristics must be sought in context: in the dialectical constitution of grocery-shopping activity in the supermarket setting. In relation to the routine character assigned grocery shopping activity, problems impinge on the consciousness of shoppers as small snags to be repaired. Given this ideology of routine and the complex structure of choice in the supermarket setting, arithmetic is used to produce rational accounts of choice. Procedures for solving problems are dialectically constituted, in that setting and activity mutually create and change each other; in the process "problems" are generated and resolved. These characteristics emerged from analysis of arena, setting and activity. Had we taken as our template school ideology concerning linear algorithms for problem solving, or the structured knowledge domain "arithmetic," we would not have been in a position to analyze the arithmetic procedures. We hope, then, to have demonstrated the value, indeed the necessity, of analysis of the context of activity, and, further, the necessity of analyzing activity in context.

This last principle led us to analyze price arithmetic in dialectical terms, as a process of gap-closing. This process draws problems and solution shapes closer together, through operations whose juxtaposition gives them multiple functions and creates circumstances for powerful monitoring of the solution process. This, in turn, provides an explanation for the extraordinarily high level of successful problem solving observed in the supermarket. There are specific ways in which the supermarket setting stores and displays information, offers means for structuring sequences of activity, acts as a calculating device, and shapes the way in which "problem solving" is construed by shoppers. These characteristics are not confined to supermarkets. Most, if not all, settings store information, offer calculating potential and means of structuring sequences of activity. These principles concerning the nature of settings are general ones. Likewise, gap-closing arithmetic--the simultaneous generation of problem and solution shape and the process of bringing them into coincidence--the production of rational accounts in complex choice situations, along with the abandonment and use of options to calculation, are at work in other settings; they form a general class of arithmetic procedures, with implications which extend far beyond the supermarket.

The analysis of gap-closing arithmetic, indeed, the conceptualization of practical arithmetic as a gap-closing process, has implications for theories of cognitive processing as well. "Problem solving" is a term often used in free variation--or worse, synonymously--with "cognition," to describe (but not to contextualize) such activities as arithmetic practices. The assignment of unwarranted theoretical centrality to problem solving reflects a failure to comprehend these activities as practices sui generis. This conventional theoretical framework views a problem as "given," the generic "independent variable" in the situation. The effort, the solving of the problem, is correspondingly characterized as disembodied mental activity. But the reduction of cognition to problem solving per se simply cannot grasp the generative nature of arithmetic practice as cognitive activity. In the dialectical terms proposed here, people and settings together generate problems. Moreover, they generate problems and solution shapes simultaneously. Very often a process of solution occurs in the setting, with the enactment of the problem, and may transform the problem for the solver. Indeed, the most general lesson of our analysis is the integral, generative and, finally, dialectical nature of activity-setting relations. The lesson applies to grocery shopping and to experience-generating segments thereof; it may be usefully applied to other, and more inclusive, systems of activity as well.

Footnotes

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[1] We have pointed out that it is difficult to analyze familiar situations, not only for grocery shopping, but for laboratory experiments as well. A program of multilevel analysis such as we propose here requires analysis of the institutional arena within which activity comes under scrutiny. The greater the remove of the activity and setting under analysis from the activities of the observer _qua_ social scientist, the

less severe the requirement for reflexive analysis of one's own ambience. Thus, laboratory experimentation poses far tougher analytic problems than grocery shopping, in our view. (The difference is only a matter of degree, however.)

[2] According to Wertsch, on whose translation and interpretation we rely here.

[3] A few simple conventions were followed in recording the shopping transcripts. Numbers are written in words whenever numerals create ambiguity in wording (e.g., '12¢' is unambiguous but '$1.12' is not). Dashes are used to terminate a statement whenever one speaker is interrupted by another. Three dots indicate either missing material, reflecting a lack of clarity on the tape, or a pause in the speaker's comment. It is often difficult to distinguish between these two cases. Other punctuation, including commas and periods, were inserted solely to improve the intelligibility of the text.

[4] This generalization is the product of Murtaugh's analysis of the selection process for nearly a thousand grocery items (see Murtaugh, 1983).

[5] Underlining, and sometimes bracketed numbers are used to mark transcript passages which are later referred to in the text.

[6] Since data were recorded on the prices and quantities of each grocery item mentioned by a shopper, it was possible to test objectively the shopper's claim that one item was less expensive than another. In only three of the 125 cases where arithmetic problem solving was used did the shopper judge the lowest unit price incorrectly. All three errors were made by the same shopper.

[7] The term "gap closing" is Bartlett's (1958). Our adoption of his terminology acknowledges the acuteness of his description of, and speculation about, the forms of certain problem solving processes. It is important to try to account for the phenomena he describes under that rubric, but as will become clearer in the text, a dialectical model of problem solving conflicts with his interpretation. For Bartlett, gap closing is a mental activity; for us a series of relations between activity and setting, each of which changes the other at every step.

[8] There is a contradiction inherent in the enterprise of observing the ordinary. It might be useful to indicate, therefore, the ways in which we have coped with it, if not transcended it. Before entering the supermarket shoppers strapped a tape recorded over their shoulder and were asked to "think out loud" while proceding through the store. Shoppers were told that the two researchers accompanying them were interested in learning about their shopping procedures, whatever they might be.

As a shopper walked through the store, one researcher maintained a running conversation with the shopper. This approach grew out of pilot work in which both more and less active methods were tried. We found that shoppers felt more comfortable describing their behavior as part of a conversation than simply as a monologue. Second, it was necessary to clarify many of the shoppers' comments and other aspects of the shopping environment which would otherwise not be clear in a taped recording. Third, the researchers sought information about influences on the shoppers' decisions which the shoppers might not volunteer. Once an item was selected, the shopper was asked about other items present which had not been mentioned. These questions generated much additional information. In all cases, the researcher was careful not to interpret the situation for the shopper, but rather to clarify the shopper's behavior for the record. Our attempt to exercise high ethnographic standards could not, of course, eliminate the interaction between actor and observer. Rather than ignore it we have tried to take it into account in our analysis.

[9] The topic of conversation [1] is established in a way strongly reminiscent of topic establishment in Mehan's transcripts of class-placement meetings (this volume p.   ).

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